AN

ESSAY

ON THE

THEORY AND PRACTICE

OF

MEDICAL ELECTRICITY.

BY

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and Member of the R.K A. at Naples.

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BRITISH MUSEUM

TO THE

RIGHT HONOURABLE

JOHN EARL OF BUTE,

&c. &c.

THIS ESSAY ON

MEDICAL ELECTRICITY

IS,

WITH THE GREATEST RESPECT,

INSCRIBED,

BY HIS LORDSHIP'S

MOST OBEDIENT, AND

MOST HUMBLE SERVANT,

THE AUTHOR.

BRITISH MUSEUM

THE

PREFACE.

THE medical application of Electricity, as it was practiſed till very lately, and as it is ſtill uſed by various perſons, was attended with two remarkable inconveniences. The firſt was the adminiſtration of ſtrong ſhocks, which terrified many a patient; and the ſecond was a long continuance of the application, which was tireſome both for the patient, and for the practitioner and his aſſiſtant. But the preſent practice, eſtabliſhed upon experience, has happily removed thoſe inconveniences; it having been obſerved, that the diſagreeable ſtrong ſhocks are not only uſeleſs, but alſo dangerous in various caſes; and that ſhocks in general may be almoſt intirely omitted. As for the continuance of the application of Electricity, there are indeed ſome few caſes, in which a long-continued electrization ſeems promiſing; but in general the application of that power for two or three minutes per day, has been found to be quite ſufficient.

Thus Medical Electricity has been rendered more uſeful, and more agreeable. But this improved method of applying Electricity is at preſent confined to a few practitioners; the reſt following the old method, or rather no method at all. It was therefore deemed neceſſary to compile the preſent Eſſay, in order not only to inſtruct the unſkilled practitioners, but alſo to ſatisfy the curioſity of the public in general, eſpecially becauſe this ſubject is at preſent much talked of.

In the firſt part, containing the Theory of Medical Electricity, the author has omitted to mention thoſe hypotheſes, which have been offered in ſeveral publications, and which are eaſily diſproved; becauſe they would have anſwered no other purpoſe but that of ſwelling the work.

The ſecond part contains principally the deſcription and uſe of thoſe inſtruments, which anſwer all the required purpoſes in Medical Electricity, and which may be eaſily procured, or made without much trouble or ingenuity.

In the third part, the author has endeavoured to expreſs, in a few words, the reſult of a vaſt number of experiments and caſes, either publiſhed in print, or communicated to him by the beſt practitioners, who have had a very extenſive practice; and who, it is but juſtice to confeſs, have made him acquainted with every uſeful particular they could furniſh for the improvement of Medical Electricity, and that with a gentility and frankneſs that does honour to the philoſophical world.

In the Appendix, the author has collected all thoſe particulars, which ſeem likely to furniſh new hints for the advancement of the ſubject; which, although much improved at preſent, is perhaps ſtill in its infancy.

Laſtly, to render this Eſſay more intelligible and uſeful, a Copper Plate has been added to it; exhibiting a delineation of all the new inſtruments that are uſed in Medical Electricity.

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AN

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ON THE

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OF

MEDICAL ELECTRICITY.

PART I.

The Theory of Medical Electricity.

THE wonderful effects of that unknown cauſe generally named *Electricity*, ſoon after the diſcovery of the electrical machines, were applied as a remedy for various diſorders incident to the human body. The firſt hints of this application, ſeem to have been ſuggeſted by obſerving the effects produced upon thoſe perſons that were electrified for curioſity; who being generally afraid of that extraordinary power, attributed intirely to it, all thoſe effects, which might in great meaſure have been attributed to fear, and apprehenſion: ſuch were an increaſed perſpiration, heat, increaſe of pulſation, &c. The number of patients that were electrified at that time, is prodigious, and the pretended cures effected by it were wonderful indeed. Accounts of thoſe miracles performed by electricity, were publiſhed in various parts of Europe, together with the methods of electrifying the patients; to which were added, ſuch theories as, allowance being made for the infancy of electricity at that time, would ſeem impoſſible ever to have been propoſed to the public. Thoſe theories were often enforced by the account of experiments, which often proved falſe upon examination*. Indeed if electrical machines could not be procured at preſent, we could hardly entertain any doubt concerning the veracity of thoſe accounts, which had all the appearance of authenticity. But at preſent a much better acquaintance with the ſcience of electricity, than philoſophers had about thirty or forty years ago, and leſs faith in the accounts of the generality of thoſe perſons, whoſe intereſt it is to promote the uſe of electricity in medicine; has pointed out the real effects of that power upon the human body, in various circumſtances, and has ſhewn how far we may confide in it; eſtabliſhing, upon indiſputable facts, that the power of electricity is neither that admirable panacea it was conſidered by ſome fanatical and intereſted perſons, nor ſo uſeleſs on application as others have aſſerted; but that, when properly managed, it is an harmleſs remedy, which ſometimes inſtantaneouſly removes divers complaints, generally relieves, and often perfectly cures various diſorders, ſome of which could not be removed by the utmoſt endeavours of phyſicians and ſurgeons.

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* The medicated cylinders for electrical machines, are a remarkable inſtance of this kind. See Dr. Prieſtley's Hiſtory of Electricity.

When the firſt rumour occaſioned in Europe by the accounts of pretended, and of a few real wonders, performed by means of electricity, had in ſome meaſure ſubſided, many creditable and experienced phyſicians, who, juſtly conſidering it as their duty, had undertaken to examine the power of this new remedy, publiſhed ſome unſucceſsful applications of electricity in divers diſeaſes; in which caſes, they had not only preſcribed the electrization, but the operation had been performed either by themſelves, or under their inſpection. Theſe publications gave a new turn to the reputation of medical electricity; and ſince that time, the generality of phyſicians and ſurgeons had not the leaſt regard for the medical application of electricity; ſo that the practitioners of it were rather conſidered as fanatics and impoſtors. However, an attentive examination of this ſubject, after ſeveral trials, and after overcoming in great meaſure the rooted prejudice amongſt phyſicians, began to eſtabliſh anew the reputation of medical electricity; and ſhewed that many applications of electricity, publiſhed in the above-mentioned accounts, had proved unſucceſsful, becauſe the operation was not managed properly; ſo that it had been the abuſe, and not the uſe of electricity, that had proved unſucceſsful, and in ſome caſes even detrimental; for at that time, ſtrong ſhocks and ſtrong ſparks were generally adminiſtered, which, a long ſeries of experiments and obſervations has proved to be generally uſeleſs or hurtful. Mr. Lovet, who practiſed medical electricity for a long time, was, as far as I know, the firſt who proteſted againſt the uſe of ſtrong ſhocks; and in an eſſay of his, intituled, *Subtil Medium proved*, aſſerts, that the ſhocks to be uſed in medical electricity ſhould be very ſmall; by which treatment he hardly ever failed of curing, or at leaſt relieving his patients.

Electricity, different from other phyſical applications, requires rather a nicety of operation than a thorough knowledge of the diſeaſe. That it is poſſible to apply electricity properly, without a juſt knowledge of the diſorder, may ſeem a paradox; but it will be preſently ſhewn, that to electrify a ſound part of the body together with the diſeaſed one, is by no means prejudicial, and that the degree of electrization muſt be regulated rather by the feeling of the patient, than by the ſpecies of diſorder; from whence it muſt follow, that the application of medical electricity may be properly managed even with a ſuperficial knowledge of the diſorder. It muſt, however, be confeſſed, that farther experience may poſſibly ſhew much eaſier and more certain methods of applying it differently for different diſeaſes; and therefore it is more likely that medical electricity will receive improvements in the hands of ſkilful phyſicians or ſurgeons, than when managed by ignorant perſons, whoſe ſucceſs is intirely truſted to chance.

The remarks made by philoſophers, relating to the effects of electricity upon the human body in general, are the following: viz. that by electrization the pulſe of a perſon is quickened; and that glandular ſecretion and the inſenſible perſpiration are promoted, and often even reſtored, when they had been intirely obſtructed. It might be eaſily ſuſpected, that the promotion of perſpiration and of glandular ſecretion, were only the conſequence of the accelerated pulſation, and not the immediate effect of electricity; but the contrary is eaſily proved, by obſerving, that in various caſes, the quickening of the pulſation by other means independent of electricity, as fear, exerciſe, &c. did not promote thoſe ſecretions nearly ſo much, if at all, as electrization; and alſo that glandular ſecretion and perſpiration are often promoted by electricity, when applied only to a particular part of the body, in which caſe it ſeldom, if ever, accelerates the pulſation.

Hitherto it has not been diſcovered that the electric fluid acts within the human body by any chymical property, as other medicines generally do; but its action, by which it produces the abovementioned effects, may be conſidered merely as a mechanical ſtimulus; for it ſeems to act as ſuch, even within thoſe parts of the body which, eſpecially when diſeaſed, are moſtly out of the reach of other remedies *.

The

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* A remarkable caſe has lately occurred to Dr. E Gray of the Britiſh Muſeum, which ſeems to ſhew that electricity has ſome other action upon the human body beſides that of mere ſtimulus.—A robuſt man of about 40 years old, whether by the weakneſs of ſome muſcles or by the contraction of their antagoniſts, had

his

The ſuperiority of electricity over other remedies, in many caſes, may appear from conſidering, that medicines in general cannot

his head bent upon the right ſhoulder, with the chin turned towards his left ſide.

The diſeaſe ſeems to be in the *ſterno-maſtoidei*. Without the help of the hand, he is unable to raiſe his head, or when raiſed, to keep it up for any length of time. When this perſon is electrified, if he raiſes his head with his hand, he can then keep it ſtrait without any ſupport, and that for as long as he is electrified; but if the electrization is interrupted, the head falls, within a few ſeconds of time, into the above-deſcribed ſituation. Now the phenomenon (which is as true as it is remarkable, and which renders this caſe worth the notice of the learned) is, that if the patient is put into ſuch a ſituation that the electric fluid muſt paſs through the affected muſcles of his body, but without occaſioning any ſparks, or any ſenſible ſtimulus, (viz. by putting the metallic conductors of electricity into contact with his ſkin) he can keep up his head, and can even reſtore it in the erect poſition, without any aſſiſtance of the hand, when it begins to fall; but if the electrization is interrupted, by only putting a hand upon the conductor of the machine, or otherwiſe, the head ſoon falls into its bent ſituation; and yet the patient, in this caſe, is not at all ſenſible of the electrization being interrupted.

I ſhall forbear mentioning any farther particulars relating to this caſe; ſince the patient is ſtill under the applinot always be confined to a particular part of the body, and to let them paſs through other parts is often dangerous, for which reaſon they cannot be uſed; beſides, after that thoſe medicines have exerted their required power, they are with great difficulty, if at all, ſeparated from the body. But it is of no conſequence whether the power of electricity paſſes through this or that other part of the body in order to come at the ſeat of the diſeaſe; and after having exerted its action, it is inſtantly diſperſed: hence it appears why electricity has often cured ſuch obſtinate diſorders as have not yielded to any other treatment.

Formerly, in order to ſtimulate, or in general to apply electricity to any diſeaſed part of the human body, ſtrong ſhocks, or at leaſt very pungent ſparks, were thought

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application of electricity, and perhaps the Dr. will himſelf publiſh the various particulars, and his ſentiments relating to this remarkable caſe; but I ſhall only obſerve, that even in this caſe the electric fluid may be ſuſpected to operate as a mechanical ſtimulus; ſince it is not every ſtimulus, but a certain degree of it, that is neceſſary to affect the ſenſe of a perſon.

neceſſary; but at preſent it is very reaſonably eſtabliſhed, upon experience, that the greateſt electric powers which can be applied with good expectations, are exceedingly ſmall ſhocks, and moderate ſparks; the proper force of which will be particularly deſcribed in the ſequel; but that, in general, the moſt proper treatment is, to throw the fluid, by means of a wooden point, as it is commonly called, or merely by a metallic point; in which laſt caſe, the perſon electrified feels only a gentle wind upon that part of the body towards which the point is directed.

By conſidering the above-mentioned effects of electricity, one may naturally ſuſpect, that in caſes of preternatural diſcharges, the application of electricity would be rather injurious than beneficial; becauſe in thoſe caſes the diſcharge is required to be ſuppreſſed, and not promoted. In reſpect to this important point, it has been obſerved, that if ſtrong ſhocks, or very pungent ſparks, are given to the patients afflicted with thoſe diſcharges, the diſeaſe is ſeldom cured, and on the contrary it is often increaſed; but when only the fluid is drawn from the part, by means of a wooden point, or at moſt exceedingly ſmall ſhocks be adminiſtered, when the ſeat of the diſeaſe is more internal, then the diſcharge, &c. is at firſt generally promoted for a few days or hours, according to the nature of the diſeaſe and other circumſtances, but afterwards it leſſens by degrees, till it is quite cured. In cutaneous eruptions, the application of electricity is generally attended with ſimilar effects.—The eruption firſt ſpreads farther for a ſhort time, and afterwards leſſens by degrees till it vaniſhes quite. From theſe obſervations it appears, that the application of electricity, when judiciouſly managed, does not merely promote any diſcharge or circulation of fluids, but rather aſſiſts the *vis vitæ*, or that innate endeavour, by which nature tends to reſtore the ſound ſtate of the injured parts of a living animal.

It may perhaps be ever difficult to explain in what manner electricity aſſiſts that natural endeavour; but experience ſhews the certainty of the fact, and with it we muſt be gratefully contented; for we may apply the effects to our wants, though we are ignorant of their cauſe, and of its mode of acting. When an electric ſhock is ſent through any part of the body, an inſtantaneous involuntary motion or convulſion is occaſioned; which ſhews that the muſcular fibres through which the ſhock is ſent, are expanded, or in ſome other manner convulſed. This involuntary motion, though not ſo ſtrongly, is occaſioned alſo by ſparks, and often even by drawing the fluid.—Farther, when a ſhock is ſent through or over ſeveral ſubſtances beſides the human body, a tremulous motion and an expanſion is evidently occaſioned, as may be ſhewn by many electrical experiments. Now all theſe obſervations may perhaps, in a manner, explain the action of electricity upon the organized parts of an animal body, by comparing it with the tremulous motion given to pipes of any ſort, through which fluids are tranſmitted, in order to accelerate their paſſage, and to prevent any ſtoppage, which might ariſe from ſtagnation or accumulation of groſs bodies. Perhaps the reaſon why ſtrong ſhocks are generally hurtful, may be becauſe the irritation they give to the obſtructed parts, eſpecially when they are very minute and delicate, breaks their organization; the force being greater than that which thoſe parts can naturally bear.

Independent of undeniable practical obſervations, when it is only admitted that electricity promotes natural ſecretions and circulation, which it certainly does, there follows, that its application muſt be beneficial in caſes of unnatural diſcharges; for in thoſe caſes the diſcharge is occaſioned by the obſtruction of the natural ways; but electricity removes thoſe obſtructions, which is the ſame thing as to promote natural ſecretion and circulation; therefore, it muſt ſuppreſs the unnatural diſcharge; which can no longer exiſt when the natural courſe of the fluids has been reſtored.

It has been confidently affirmed by ſome philoſophers, that electrization increaſes the number of pulſations about one ſixth: ſo that if the pulſe of a perſon naturally beats eighty times in a minute, after being electrized for a few minutes, it will beat about ninety-four times *per* minute. Others have ſaid, that the increaſe of the number of pulſations is more than a ſixth; and ſome perſons have even ſaid, that the pulſe is not at all increaſed. In the New Memoires of the Royal Academy at Berlin, for the year 1772, there is a paper of M. Gerhard, concerning the action of electricity upon the human body; in which the author obſerves, that electrization ſometimes quickens the pulſe ſo much as to double the number of pulſations; and ſometimes retards it conſiderably. It has alſo been aſſerted, that poſitive electricity accelerates the pulſe; and that on the contrary, negative electricity retards it. But experience authorizes me to ſay, that this effect varies conſiderably, according to the degree of electrization, and principally according to the natural diſpoſition of the perſon tried, and the degree of apprehenſion with which he ſubjects himſelf to be electrified; but that, in general, either poſitive or negative electrization increaſes the number of pulſations about one ſixth, as was obſerved above *. I do not remember, that my pulſe was ever evidently accelerated by electrization, and yet I have repeated the experiment various times, and with great diverſity of circumſtances.

As for the other above-mentioned effects of electricity, they are more certain, and leſs depending upon fear and apprehenſion. The involuntary motion, for inſtance, the increaſe of perſpiration, &c. are by no means avoided by intrepidity, and acquaintance with the ſcience of electricity. Thus a perſon who has often felt electric ſhocks, may receive them without fear; but he

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* The method of electrization here meant, is, to inſulate the perſon upon a ſtool, furniſhed with glaſs legs, and to keep him connected with the prime conductor, or with the rubber of a pretty powerful electrical machine whilſt in motion.

will be convulſed, and will feel them as well as thoſe who have not been converſant with them; although the latter generally ſuppoſe to have felt a greater ſenſation than they really have; which is certainly the effect of apprehenſion, and is commonly removed after the firſt or ſecond trial.

With reſpect to diſeaſes in general, two ſtates of the affected parts ſhould be conſidered. The firſt is, the immediate and recent cauſe of the diſeaſe; and the ſecond ſtate is, the alteration of other parts, eſpecially ſolid, which is occaſioned by the long continuance of the firſt and principal cauſe; thus, for inſtance, the weakneſs or rupture of ſome veſſels within the body, may occaſion extravaſation of fluids, which is the firſt ſtate of the diſeaſe. Now if theſe extravaſated fluids continue in any part of the body, they will gradually occaſion a ſuppuration, an inflammation, or other ſymptoms, which vary according to innumerable circumſtances. This we may conſider as the ſecond ſtate of the diſeaſe.—Again, when a palſy deprives a part of the body of its motion, the fleſhy and even the more ſolid parts, in proceſs of time, waſte and become disfigured, which is the effect of the obſtructed motion and circulation, and which we may therefore conſider as the ſecond ſtate of the diſeaſe; and ſo of the reſt. Now it has been obſerved, that the power of electricity often removes the firſt ſtate of the diſorder; but the latter is very ſeldom cured by it. Indeed it ſeems almoſt impoſſible that a disfigured bone or deſtroyed organization ſhould be reſtored to its ſound ſtate by means of electricity. Dr. FRANKLIN having electrified ſeveral paralytic perſons in America, obſerved that they were generally relieved for a few days on the beginning, but that they afterwards either did not mend, or relapſed into the ſtate they were before the uſe of electricity*. Here it muſt be obſerved, that thoſe paralyſies were moſtly of a long ſtanding, and alſo that the method practiſed by the Doctor, was to give ſtrong ſhocks, which we have already remarked to be rather prejudicial.

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* See Dr. Franklin's Philoſophical Letters, Papers, &c. and Dr. Prieſtley's Hiſt. of Electricity.

In general, the application of electricity has been found to be of very little uſe in caſes of long ſtanding; becauſe, as we obſerved above, the more ſolid parts, by the long continuance of the diſorder, have undergone ſuch alteration, as cannot be reſtored by a mere ſtimulus, ſuch as the electric action is ſuppoſed to be. However, ſometimes diſeaſes of many years ſtanding have been perfectly cured by means of electricity. In theſe caſes therefore, although there may be leſs hope of effecting a cure, it is not improper to apply the power of electricity; which, when judiciouſly managed, does at leaſt never produce any bad effects.

Hitherto I do not know that any authentic facts have ſhewn any difference between the application of different kinds of electricity in medical caſes. Whether the patients be electrified by the prime conductor, or by the inſulated rubber of the uſual electrical machines, viz. whether they are electrified poſitively or negatively, ſeems to be quite indifferent: hence, admitting Dr. Franklyn's hypotheſis of electricity, we ſee that it is not the direction of the electric fluid that determines the fluids of the body one way or the other; but that the effects uſually obſerved upon the body when electrized, muſt be owing to the irritation, or dilatation, occaſioned by the action of that fluid.

Before we conclude the firſt part of this work, it will be proper to mention a few hints, which may promote the inveſtigation of the action of the electric fluid, eſpecially relating to its chymical action; viz. if it adds any principle to thoſe parts through which it paſſes, as an acid, an alkali, the inflammable principle, &c.—The obſervations relating to this point are, firſt, that when any part of the body has been expoſed to the ſtream of electric fluid, it acquires a ſulphurous, or rather a phoſphoric ſmell, which it retains for a conſiderable time. Secondly, when the ſtream of electric fluid, iſſuing from a point, is directed towards the palate, a kind of acid taſte is perceived. Now this ſmell and taſte indicate, that the electric fluid either alters the parts of the body, upon which it excites thoſe ſenſations, or that it carries along with itſelf ſome other principle, which may perhaps be ſeparated from thoſe ſubſtances, through which this fluid paſſes, previous to its impinging upon the body.—Whether thoſe effects may be increaſed, diminiſhed, or turned to any uſe, and alſo whether they are quite indifferent with reſpect to medical electricity, are matters that require farther experiments and conſiderations; for nothing of certain has been yet determined reſpecting them.

In various experiments, when the electric ſpark is taken in air, or other fluids, eſpecially the tincture of certain flowers, it ſhews effects ſimilar to thoſe, which the inflammable principle, or an acid, produces upon thoſe fluids. Theſe experiments have induced various perſons to ſuppoſe, that the electric fluid is phlogiſton, or an acid, or elſe a compound of both. But, conſidering that in thoſe caſes the action of the electric fluid as an acid, or as phlogiſton, is exceedingly ſmall; and alſo conſidering the violence with which it paſſes through the ſubſtance of bodies, the ſurface of which it generally burns or melts in a ſmall degree; it ſeems more natural to ſuſpect, that the above-mentioned effects are produced by that quantity of inflammable or acid principle, which the violent paſſage and eſcape of the electric fluid detaches from other bodies, rather than to conſider the electric fluid itſelf to be an acid, or the inflammable principle; which ſeems to be very unlikely on various other accounts beſides.

A book entitled *De l'electricité du Corps humain, dans l'etat de ſanté et de maladie, par l'Abbé Bertholon*, was publiſhed laſt year in France. In this work, the author, conſidering the uſual electricity of the atmoſphere, imagines that the human body continually abſorbs that electricity of the air,

and

and that this abſorption is made through the pores of the ſkin, as well as through the lungs in the uſual act of reſpiration; and, as the quantity of air which enters into the lungs of a man during one day, is by the author eſtimated to about 1,152,000 cubic inches, he thence deduces, that the quantity of electricity thus abſorbed by the human body is aſtoniſhingly great. The author ſucceſſively examines the influence of this abſorbed electricity upon the functions of the body, viz. upon muſcular motion, upon the circulation of the blood, upon reſpiration, digeſtion, ſecretions, and even upon the morals of men. He alſo takes notice of the electricity of ſeveral animals, and even mentions ſome qualities of the air, or of the aliments, which are proper to augment or diminiſh the electricity of the human body. In the application of thoſe principles to medicine, the author gives a table of diſeaſes, arranged in ſpecies and genera, and comprehended under ten claſſes; which diſeaſes, as he ſays, are occaſioned in great meaſure, if not wholly, by electricity, either poſitive or negative; and which may be cured by one or the other of thoſe two electrical powers, according as the ſigns concomitant the diſeaſe may indicate.

The Abbe Bertholon alſo treats of the influence of atmoſpherical electricity upon the number of births or deaths, and other things of the like nature.

A perſon verſed in electricity, conſidering that the air next to the body of a man, in his uſual mode of living, is ſeldom if ever ſenſibly electrified, and alſo that the human body is a ready conductor of electricity, beſides many other obvious conſiderations, muſt naturally ſuſpect that the author of the above-mentioned work has indulged his fancy perhaps too much.

PART II.

Directions for the practical application of Electricity for the Cure of various Diſeaſes.

OMITTING the deſcription of the electrical machine, and the manner of preſerving it in good order, (which things may be found in various treatiſes on electricity) I ſhall only obſerve, with reſpect to the electrical machine in general, that its ſize ſhould not be ſo ſmall as was thought ſufficient ſome time ago, when the ſmalleſt machines were ſuppoſed to be ſufficiently uſeful for the purpoſe. It is ſomewhat remarkable, that when a ſmall power of electricity is to be uſed, large machines ſhould be recommended; whereas, a ſhort time ago, ſtrong ſhocks were adminiſtered, and ſmall electrical machines were uſed; but it muſt be conſidered, that when ſhocks are given, very ſmall electrical machines can charge a

Leyden phial much ſtronger than required; but when the ſtream is uſed, which has lately been found to be far more efficacious, then the ſmall machines are moſtly uſeleſs. Probably the largeſt machines will not be found to afford a ſtream too ſtrong for medical purpoſes; but the uſeful ones, which do not require a great labour to be put in motion, and may furniſh a ſtream ſufficiently denſe, ſhould have the glaſs globe or cylinder at leaſt nine inches in diameter, which, with a proportionate conductor, may uſually give ſparks about three inches long. Whether the rubber of theſe machines ſtands upon a glaſs pillar or not, viz. whether it may be occaſionally inſulated or not, ſeems to be immaterial with reſpect to medical electricity: but as to have it ſituate upon a glaſs pillar is uſeful for electrical experiments in general, and perhaps it may be found hereafter, that negative electrization is beneficial in ſome diſorders, a perſon who is to chooſe a new electrical machine, may rather have the rubber fixed upon a glaſs pillar, than otherwiſe.

With ſuch machines, the power of electricity ſhould be ſo regulated, as to apply every degree of it with facility and readineſs; beginning with a ſtream iſſuing out of a metal point, next uſing a wooden point, then ſmall ſparks,—ſtronger ſparks, and laſtly ſmall ſhocks. Every one of theſe methods may be increaſed or diminiſhed conſiderably, by a proper management: thus, by turning the wheel of the machine ſwifter or ſlower, the ſtream of electric fluid may be regulated according as the circumſtances may require. The ſparks may alſo be made ſtronger or weaker, by taking them at a greater or leſs diſtance, and by turning the wheel ſwifter or ſlower; and ſo of the reſt.

It is impoſſible to preſcribe the exact degree of electrization that muſt be uſed for various diſorders; for perſons of different conſtitutions, although afflicted with the very ſame diſeaſe, require different degrees of electrization. Some perſons are of ſo delicate and irritable a conſtitution, that the ſmalleſt ſparks give them as much pain as ſhocks do to others.

On the contrary, ſome people can ſuffer pretty ſevere ſhocks without poſitive pain; and I have heard, though never ſaw any, of perſons who were inſenſible of any electric power, even of conſiderably ſtrong ſhocks.

In reſpect to this important point, the operator muſt be certainly inſtructed by experience; however, in the beginning, he may be aſſiſted by the two following rules. Firſt, he ſhould begin to adminiſter to his patients the very ſmalleſt degree of electric power, which he ought to continue for a few days, ſo as to obſerve whether it produces any good effect, which if it fails to do, he ſhould then increaſe the ſtrength of electricity; and ſo proceed gradually till he finds the effectual method which he ſhould follow without variation, till the patient is intirely cured. In ſhort, the operator ſhould always uſe the ſmalleſt degree of electric power, that is ſufficient for the purpoſe. A little practice will enable him to determine at once what degree of electricity is required for his patient, without any uſeleſs attempts.

Secondly, the degree of electrization to be adminiſtered, ſhould never exceed that, which the patient can conveniently ſuffer; experience ſhewing, that when the application of any degree of electricity is very diſagreeable to the patients, they very ſeldom mend.

The inſtruments which, beſides the electrical machine and its prime conductor, are neceſſary for the adminiſtration of medical electricity, may be reduced to three; viz. an electric jar, with Mr. Lane's electrometer; an inſulated chair, or an inſulated ſtool, upon which a common chair may be occaſionally ſet; and the *directors*[*].

Thoſe inſtruments are delineated in the annexed plate. Fig 1. repreſents the electric jar, with Mr. Lane's electrometer, and the manner in which the ſhocks are ſent through any particular part of the body. The ſurface of the jar, which is coated with tinfoil, ſhould be about four inches in diameter, and ſix inches high, which is equal to about ſeventy-three ſquare inches. The braſs wire, which paſſes through the covering of the jar and touches the inſide coating, has a braſs ball, F, to which the electrometer F D E is faſtened; and proceeding a little farther up, terminates in another braſs ball B, which ſhould be ſo high as to touch the prime conductor A, which is ſuppoſed to ſtand before the electrical machine. The electrometer conſiſts in a glaſs ſtick F D, cemented to two braſs caps F and D; from the latter of which a ſtrong perpendicular braſs wire proceeds, the extremity of which comes as high as the center of the ball B, and is furniſhed with an horizontal ſpring ſocket, through which the wire C E, having the braſs ball C at one end, and the open ring E at the other, may be ſlided backwards and forwards, ſo as to ſet the braſs ball C at any required diſtance from the ball B. This diſtance, at moſt, needs not be greater than half an inch; hence the electrometer may be made very ſmall. Sometimes ſmall diviſions are marked upon the wire C E, which ſerve to ſet the balls B and C at a given diſtance from one another, with more readineſs and preciſion. Now ſuppoſe that the jar is ſet contiguous to the prime conductor, that is, with the ball B touching the conductor; that the ball C be ſet at one tenth of an inch diſtance from the ball B; and that, by means of wire, a conducting communication be formed from E to the outſide coating of the jar, as is repreſented by the dotted line in the figure. In this caſe, if the electrical machine be put in motion, the jar will be charged; and when the charge is ſo high as that the electric fluid accumulated within the jar can leap from the ball B to C, which we have ſuppoſed to be one tenth of an inch aſunder, the diſcharge will happen, a ſpark appearing between the ſaid balls, and the ſhock paſſes through the wire repreſented by the dotted line; for the part F D of the electrometer being of glaſs, generally covered with ſealing-wax, is impervious to electricity, conſequently the electric fluid has no other way through which it can paſs from the inſide to the outſide of the glaſs jar.

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[*] Various other inſtruments uſeful in medical electricity, are deſcribed in divers books, but thoſe mentioned above are ſufficient to anſwer every required purpoſe.

When the ſhocks are to be given with this apparatus to any particular part of the body, for inſtance, to the arm, then, inſtead of the dotted line repreſenting a wire, which muſt now be ſuppoſed as not exiſting in the figure, two ſlender and pliable wires, E L, I L, are to be faſtened, one to the open ring E of the electrometer, and the other to the braſs hook I of the ſtand H I, which communicates with the outſide coating of the jar*. The other extremities of the ſaid wires are faſtened each to the braſs wire L, and L, of the directors K L, K L. Each of thoſe inſtruments, juſtly called *directors*, conſiſts of a knobbed braſs wire L, which by means of a braſs cap is cemented to the glaſs handle K. The operator, holding them by the extremity of the glaſs handle, brings their balls into contact with the extremities of that part of the body of the patient through which he deſires to ſend the ſhock. The management and convenience of this apparatus are eaſily comprehended by inſpecting the figure; for when the machine is in motion, and the apparatus, &c. is ſituate as in the figure, the diſcharge of the jar muſt be evidently made through that part of the patient's arm, which lies between the knobs of the directors; and the operator, whilſt an aſſiſtant keeps the machine in motion, has nothing more to do, but to hold the knobs of the directors to the extremities of the arm, or to any other part of the body that is required to be thus electrified; always taking care that the two wires E L, I L, do not touch each other, becauſe in that caſe the ſhock will not paſs through that part of the body which is required to be electrified. Thus any number of ſhocks, preciſely of the ſame ſtrength, may be given, without altering any part of the apparatus, or having any farther trouble; and when the ſtrength of the ſhocks is required to be diminiſhed or increaſed, it is only neceſſary to diminiſh or augment the diſtance between the balls B C, which is done by ſlipping the wire C E forwards or backwards through the ſpring ſocket that holds it.

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* If the jar has not the ſtand H I, the extremity I of the wire I L may be ſimply reſted under, or may be tied round it. In ſhort, it muſt be put in contact with the outſide coating of the jar, in any convenient manner.

It is almoſt ſuperfluous to mention, that when ſhocks are adminiſtered, it is immaterial whether the patient ſtands upon the ground, upon the inſulating ſtool, or in any other ſituation whatever. It is neither always neceſſary to remove the cloaths from the part that muſt be electrified, in order to let the knobs of the directors touch the ſkin; for, except the coverings be too many and too thick, in which caſe part of them at leaſt ſhould be removed, the ſhocks will go through them very eaſily, eſpecially if the knobs of the directors be preſſed a little upon the part.

In the courſe of this eſſay we ſhall deſcribe the ſtrength of the ſhocks by the diſtance between the balls B and C of the electrometer, which we ſhall expreſs by parts of an inch; ſuppoſing that the ſaid electrometer is fixed upon ſuch a jar as we have deſcribed above, viz. whoſe coated part, beſides the bottom, may be equal to

about

about 73 ſquare inches, and whoſe glaſs is moderately thin; for a larger or thicker jar with the ſame electrometer, ſet at the ſame diſtances, will produce a much different effect, as muſt be obvious to any perſon a little acquainted with the ſcience of electricity.

Beſides the directors mentioned above, there are other kinds of directors, which ſerve for throwing the ſtream of electric fluid, and other ſimilar purpoſes. Theſe are delineated in fig. 2. and 3. The director D in fig. 2. is much like thoſe deſcribed above, excepting only that its wire is bent, and inſtead of having any ball, it terminates in a point, to which is affixed a piece of wood about one inch or one inch and a half long, pointed on one end, though not very ſharp, and having a hole on the other*. The operator ſhould have by him various ſuch wooden pieces, of different length and thickneſs, as E E, ſo as to ſhift them according as circum-

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[*] Theſe directors are ſometimes made with very ſlender and annealed wires, ſo that they may be bended in every required direction.

ſtances may require; for ſometimes the wooden pieces are too dry or too damp, or the machine is in bad order, &c. in which caſes the ſtream of electric fluid would be either too ſtrong or too weak, if the ſame wooden point was always uſed. The wood proper to make theſe pointed pieces ſhould be rather of a ſoft kind, than hard, as box wood and lignum vitæ are.

In order to throw the electric fluid with this director, let a wire B, proceeding from the prime conductor A, fig. 2. be faſtened to the wire of the director D E, which the operator muſt hold by the extremity of the glaſs handle, and muſt manage it ſo as to keep the wooden point at about one or two inches diſtance from the body of the patient*. This diſtance, however, muſt be regulated according to the conſtitution of the patient, the ſtrength of the electrical machine, and other circumſtances, which will be ſuggeſted by a little practice. The electric fluid iſſuing from the wooden point, has a power which is intermediate between that of the ſtream proceeding from a metal point, and the power of the ſparks; but yet it is in general the moſt efficacious method of electrization, and therefore no pains ſhould be ſpared in order to adminiſter it in the beſt poſſible manner. This ſtream conſiſts of a vaſt number of exceedingly ſmall ſparks, accompanied with a little wind, which gently irritates the part electrified, and gives a warmth which proves very agreeable to the patients. Sometimes, when the machine is very powerful, and the wooden point is ſhort or ſplit, a very full and pungent ſpark iſſues from it; which is a very diſagreeable accident, eſpecially when the part electrified is very delicate. In order to avoid this inconvenience, the operator ſhould firſt try the goodneſs of the point, before he begins the operation; which he may do by throwing the ſtream upon his own hand or face.

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* When this or any other operation is performed, the electric jar, and in general any inſtrument not actually neceſſary, muſt be removed from the prime conductor, and even from the table if that is rather ſmall.

The above-mentioned method of electrifying, gentle as it may appear, will nevertheleſs be found too ſtrong for ſome perſons, eſpecially when uſed for open ſores upon delicate parts; in which caſes the wooden point muſt be removed, and the electric fluid muſt be ſimply thrown from the metal point of the director, which muſt now be kept at a greater diſtance than when the wooden piece was upon it. The electric fluid iſſuing out of this pointed wire of the director, occaſions only a gentle wind upon the part towards which it is directed, and is far from being diſagreeable even to the moſt delicate conſtitution.

It might be naturally ſuſpected, that ſo gentle and nearly inſenſible a treatment could hardly be of any efficacy; but my reader may be aſſured, that to my certain knowledge, deduced from the practice of perſons who have had long experience in this ſubject, this method of electrization, viz. the throwing the fluid with a metal point, has often mitigated pains, and cured obſtinate and dangerous diſeaſes, which could not be removed by any other remedy that was tried.

In general this treatment, upon delicate nervous conſtitutions, is as efficacious as the other, viz. the throwing the fluid with a wooden point, is to ordinary conſtitutions. In ſeveral caſes, eſpecially of open ſores, the electric fluid iſſuing out of a wooden point has conſtantly increaſed the pain, and even enlarged the ſore; whereas the fluid iſſuing out of the metal point has effectually diminiſhed both.

The ſtream iſſuing out of a wooden point may be directed towards the eyes of the patient, without any apprehenſion of hurting him; in which caſe the operator ſhould keep the eye-lid open with one hand. Indeed there might be ſome caſes, though I ſeldom heard of any, in which this treatment may be thought to be too ſtrong; then the metal point only may be uſed.

The ſtream iſſuing both out of the wooden and of the metal point, acts even through the cloaths, if they are not too thick; hence it may be uſed without incommoding the patient; but when it is convenient to uncover the part that is to be electrified, it is much preferable to direct the fluid immediately upon the ſkin.

In this operation, the practitioner muſt mind to ſhift the point of the director about, ſo that the ſtream of electric fluid may be directed not only towards the affected part, but alſo to the places about it; alternately returning to the ſame place, and moſtly inſiſting upon the part principally affected.

The patient in this operation may alſo ſtand in every ſituation that may happen to be more convenient to him.

When more proper inſtruments cannot be had, directors may be made by ſticking large pins upon ſticks of ſealing wax, as is repreſented at K, fig. 2.

Sometimes the wire B, which forms the communication between the prime conductor and the director, throws a conſiderable quantity of electric fluid into the air, which weakens the ſtream iſſuing from the point. In order to remedy this inconvenience, I contrived a conducting wire, which being uſed by ſome of my friends, who practiſe medical electricity, has been found to anſwer very well the purpoſe of not diſſipating the electric fluid. This conducting communication is formed of a ſilver, gold, or copper thread, ſuch as are uſed for laces, which conſiſt of a ſmall lamina of metal twiſted round a ſilk or linen thread. This metal thread, or two of them, I involve in a ſilk ribbon, which is coiled and ſewed very tight upon it, leaving only a loop of the metallic thread uncovered at each extremity, one of which is to be faſtened to the prime conductor, and the other to the wire of the director. See G H, fig. 2.

This ſort of conducting communication, beſides its preventing the diſſipation of the electric fluid, is much more pliable than the ſtiff wire commonly uſed, and conſequently may be managed more eaſily. It may be alſo uſed inſtead of the wires E L, I L, fig. 1. in the operation of giving ſhocks.

Two other directors different from the above-mentioned, are delineated in fig. 3. Their uſe is to draw ſparks from the inſide of the ear in caſes of deafneſs, pains, &c. and alſo from the teeth or other internal parts of the mouth. The director B H conſiſts of a glaſs tube A B, about ſix inches long, and open at both ends; whoſe diameter may be about one tenth of an inch, and the ſubſtance of the glaſs rather thick. A cork is thruſted into one end of this tube, through which a wire paſſes; one extremity of which is cut blunt and ſmooth, and comes within one or two tenths of an inch ſhorter than the end B of the tube. The other extremity H of the wire, is furniſhed with a ſmall metal ball.—Long pins, ſuch as the ladies uſe for their hats, anſwer this purpoſe exceedingly well, when their points are filed off. The other director C D differs from that juſt deſcribed, in being only bent a little, for the conveniency of adapting it more eaſily to ſome parts within the mouth.

When theſe directors are uſed, the patient muſt be ſituated upon an inſulating ſtool, viz. a ſtool furniſhed with glaſs feet, upon which a chair may be placed. Then a communication muſt be formed between the prime conductor and the body of the patient, by means of any ſort of wire, eſpecially that repreſented by G H, fig. 2. or by the patient only touching the prime conductor with his hand. In this caſe, it is eaſy to conceive that the patient becomes part of the prime conductor; and if any blunt conducting body is brought near him, when the machine is in action, a ſpark is obtained from him in the ſame manner as when the ſame blunt body is preſented to the prime conductor itſelf. Every thing being thus far prepared, the operator holding the director A B or C D by its middle E or F with one of his hands, muſt bring the extremity B or D of the tube into contact, or nearly ſo, with the inſide of the ear, mouth, &c. of the patient, as occaſion may require; and muſt bring the knuckle of a finger of his other hand within a ſmall diſtance of the ſmall knob H or G of the director, which will extract ſmall ſparks from it, and at the ſame time the like ſparks will happen between the other extremity of the wire within the tube, and the part of the patient's body towards which the inſtrument is directed.

This is an excellent method to be practiſed in caſes of deafneſſes, pains in the ears, tooth-achs, ſwellings within the mouth, &c. eſpecially becauſe it may be increaſed or diminiſhed at pleaſure; viz, by drawing the wire G or H more or leſs from the extremity B or D of the tube, the ſtrength of the ſparks may be increaſed or diminiſhed.

Not only ſparks, but alſo the ſtream of electric fluid may be drawn with thoſe directors. This is done by bringing (inſtead of the knuckle) a pointed piece of wood near the ſmall knob H or G of the director; every thing elſe being diſpoſed as already directed.

When ſparks are required to be drawn from any part of the body, the patient muſt be ſituated upon an inſulating ſtool, and muſt be connected with the prime conductor in the manner directed above;

then the operator bringing the knuckle of one of his fingers, or the knob of a braſs wire like K L, fig. 3, oppoſite to the affected part, will draw the ſparks from it; which ſparks will paſs very eaſily through the cloaths, if they are not very thick. When the knobbed wire K L is uſed to draw ſparks with, the operator muſt hold it by the extremity K, and preſent the knob L, &c: but it may alſo be uſed to draw the fluid ſilently, in which caſe the point K muſt be preſented, and the knob L muſt be held by the hand of the operator. Here a wooden point may alſo be uſed, viz. by affixing it to the point K of the wire; which method anſwers as well as that of throwing the electric fluid by means of a wooden or metal point, with the director D of fig. 2. deſcribed in the preceding pages.

Sometimes it is required to take ſparks from ſuch parts as are covered with thick cloaths, and the patient is rather unwilling to uncover. In this caſe the beſt method is to ſituate the patient upon the inſulating ſtool in contact with the prime conductor, then to bring the knob of a director, like one of thoſe delineated in fig. 1. in contact with the cloaths over the part required to be electrified; whilſt the operator, holding the inſtrument by the extremity of its glaſs handle with one of his hands, brings the knuckle of one of his fingers, or the knob of the wire K L, fig. 3. pretty near the braſs cap of the director, ſo as to draw ſtrong ſparks from it; the force of which will be felt very ſmartly upon the part of the patient's body; for at the ſame time ſparks will happen there acroſs the cloaths, viz. between the part of the body of the patient, and the knob of the director, which, for better ſecurity, ſhould be preſſed a little upon the cloaths.

In all thoſe caſes when the electric fluid, either in a ſtream or under the form of ſparks and ſhocks, is to be forced acroſs the cloaths, it is ſuppoſed that no metallic ornaments ſhould be interpoſed, as gold or ſilver lace, long pins, and the like; for then the effects will vary

conſiderably,

conſiderably, according to the different circumſtances.

There is another method of electrifying a diſeaſed part of the body, which cannot properly be called drawing ſparks, though it comes very near to it. This manner of electrifying is effected in the following way: The patient is ſituated upon the inſulating ſtool, and is made to communicate with the prime conductor; then a dry and warm flannel, either ſingle or double, according as it may be occaſionally thought more proper, is ſpread upon the naked part that muſt be electrified, and over this flannel the operator muſt put the knob L of the wire K L, fig. 3. quite into contact with the flannel, whilſt he holds it by the other extremity K. Now when the machine is in action, the knob L of the wire muſt be ſhifted very quick and nimbly from place to place over the flannel; in which manner a vaſt number of exceedingly ſmall ſparks will be drawn acroſs the flannel; which generally bring an agreeable warmth on the part, and prove very beneficial to the patient, at the ſame time that they do not cauſe any very diſagreeable ſenſation. In caſes of paralytic limbs, rheumatiſm, ſpreading pains, coldneſs of any particular part, &c. this treatment is of ſingular benefit. In the following pages we ſhall call it *The method of drawing ſparks through a piece of flannel*, or ſimply, *to draw ſparks through flannel*.

As for the inſulating chair, it is almoſt needleſs to give any particular directions concerning its conſtruction; it being nothing more than a common wooden chair ſet upon an inſulating ſtool; or, as ſome perſons chooſe to have it, the chair itſelf is furniſhed with glaſs inſtead of wooden legs, which anſwers equally well. It is requiſite that no ſharp metallic points be put upon this chair; and even its wooden ornaments ſhould be rather blunt than ſharp-edged; for points and edges in general diſſipate the electric fluid conſiderably, and conſequently weaken the power of the machine. The glaſs feet ſhould be at leaſt eight inches high; and, that they may inſulate the better, eſpecially in damp weather, they ſhould be covered with ſealing-wax. In the conſtruction of this chair, a place ſhould be always provided, whereupon the patient may reſt his feet; the want of which is very diſagreeable, becauſe it is abſolutely neceſſary that the feet do not touch the floor.—When only a common chair is to be occaſionally ſet upon an inſulating ſtool, the latter ſhould be made ſomewhat larger than the former, ſo that part of it may project before the chair, upon which the perſon to be electrified may reſt his feet.

After the deſcription of the inſtruments neceſſary for the adminiſtration of medical electricity, I ſhall collect together ſome practical rules, which may ſerve for a guide to thoſe practitioners, who have not yet been ſufficiently inſtructed by their own experience.

General Rules for Practice.

I. It ſhould be attentively obſerved, to employ the ſmalleſt force of electricity, that is ſufficient to remove or to alleviate any diſorder; thus the ſhocks ſhould never be uſed when the cure may be effected by ſparks; the ſparks ſhould be avoided when the required effect can be obtained by only drawing the fluid with a wooden point; and even this laſt treatment ought to be omitted, when the fluid drawn by means of a metal point, may be thought ſufficient. The difficulty conſiſts in diſtinguiſhing the proper ſtrength of electric power that is required for a given diſorder, the ſex and conſtitution of the patient being conſidered. In regard to this point, it is impoſſible to give any exact and invariable rules; the circumſtances being of ſuch a nature, and ſo various, that long experience, and a ſtrict attention to every particular phenomenon, are the only means by which proper inſtructions may be received. The ſureſt rule, as we obſerved above, that can be given relating to this particular, is to begin by the moſt gentle treatment; at leaſt ſuch, that, conſidering the conſtitution of the patient, may be thought rather weak than ſtrong. When this gentle treatment has been found ineffectual for a few days, which is denoted by the diſeaſe not abating, and the application of electricity not cauſing any warmth, or other promiſing phenomenon, upon the part electrized; then the operator may gradually increaſe the force of electricity till he finds the proper degree of it.

II. In judging of caſes proper to be electrified, experience ſhews, that in general, all kinds of obſtructions, whether of motion, of circulation, or of ſecretion, are very often removed or alleviated by electricity. The ſame may alſo be ſaid of nervous diſorders; both which include a great variety of diſeaſes. The application of electricity has ſeldom intirely cured diſeaſes of a long ſtanding, although it generally relieves them. To perſons afflicted with the venereal diſeaſe, or to pregnant women, electrization has been thought to be pernicious; but my reader may be aſſured, that even in thoſe caſes it may be uſed without fear, if it is judiciouſly managed. When pregnant women are to be electrified for any diſorder, the ſhocks ſhould be abſolutely forbidden; and even when the other more gentle treatments are uſed, a conſtant attention ſhould be given to any phenomenon that may appear in the courſe of the electrization; the method of which ſhould be increaſed, diminiſhed, or ſuſpended, according as circumſtances may indicate. As for the venereal diſeaſe, it will be hinted, in the courſe of this work, in what manner, and in which caſes, electricity may be applied.

III. In caſes of gathering tumors, the beſt method is to draw the fluid by means of a wooden point, or, if that proves painful, by a metal point. Sparks in theſe caſes, and alſo ſhocks, are often hurtful. In ſtiffneſſes, paralyſies, and rheumatiſm, ſmall ſparks, eſpecially through a double flannel, and alſo very ſmall ſhocks (at moſt of one tenth of an inch) may be uſed. Stronger ſhocks may be ſometimes, though ſeldom, adminiſtered for a violent tooth-ach, and for ſome internal ſpaſm of no long ſtanding.

IV. When any limb of the body is deprived of motion, it muſt be obſerved, that the privation of motion is not always originated by a contraction of the muſcles; but that it is often occaſioned by a relaxation; thus, for inſtance, if the hand is bent inwardly, and the patient has no power of ſtraightening it, the cauſe of it may be a weakneſs of the outward muſcles, as well as a contraction of the inward ones. In ſuch caſes, as it is often difficult even for good anatomiſts to diſcover the real cauſe, the ſureſt method is to electrify not only thoſe muſcles which are ſuppoſed to be contracted, but alſo their antagoniſts; for to electrify a ſound muſcle is by no means hurtful.

V. When the ſtream of electric fluid is thrown either with a wooden or metal point, the length of the operation ſhould be from three to ten minutes: more or leſs, according as occaſion may require. When ſhocks are adminiſtered, their greateſt number ſhould not exceed a dozen or fourteen, except when they are to be given to the whole body in different directions. The number of ſparks, when they are uſed, may generally exceed the number of ſhocks mentioned above.

VI. Laſtly, it may be of uſe to mention, that when children muſt be electrified upon the inſulating chair, as it is difficult to let them ſtay without motion, the moſt convenient method is, to let another perſon ſit in the inſulating chair, and to hold the child whilſt the operator is electrifying him.

Having thus compriſed into a few general rules, the method of applying electricity with ſafety, we ſhall in the following part deſcribe the particular treatment, which has been found more expeditious and beneficial in diſorders of various ſpecies; and ſhall laſtly add ſome authentic caſes, which will ſerve as examples for the generality of practitioners.

PART III.

Containing the particular method of adminiſtring Electricity for various Diſeaſes, and the account of ſome authentic Caſes.

THE account of a few ſucceſsful caſes in medical electricity, as well as in any other branch of phyſic, does by no means eſtabliſh the reputation of the treatment, when a vaſt number of unſucceſsful trials are concealed from the eyes of the public. The variety of temperaments obſervable in the human ſpecies, and the coincidence of circumſtances, is ſuch, that ſometimes very obſtinate diſorders ſeem to be cured by very trifling applications. The phyſicians, however, juſtly neglect thoſe kinds of treatment, becauſe they have actually failed in a great many caſes ſeemingly of the ſame nature.

In order, therefore, to give a proper eſtimate of the efficacy of a remedy, it is neceſſary to ſhew the proportion between the ſucceſsful, and the unſucceſsful trials; without being amazed at one caſe, and neglecting many others.

Agreeably to this obſervation, the reader will find in the following pages, an eſtimate of the effects of electricity applied as a remedy for various diſorders. This eſtimate has been deduced from the caſes which are hitherto come to my notice, and is therefore likely to receive much alteration and amendment by better information, and future practice.

Rheumatic diſorders, even of long ſtanding, are relieved, and generally quite cured, by only drawing the electric fluid with a wooden point from the part, or by drawing ſparks through flannel. The operation ſhould be continued for about four or five minutes, repeating it once or twice every day.

Deafneſs, except when it is occaſioned by obliteration, or other improper configuration of the parts, is either intirely or partly cured by drawing the ſparks from the ear with the glaſs-tube-director, or by drawing the fluid with a wooden point. Sometimes it is not improper to ſend exceedingly ſmall ſhocks (for inſtance, of one-thirtieth of an inch) from one ear to the other.—It has been conſtantly obſerved, that whenever the ear is electrified, the diſcharge of the wax is conſiderably promoted.

The tooth-ach, occaſioned by cold, rheumatiſm, or inflammation, is generally relieved by drawing the electric fluid with a point, immediately from the part, and alſo externally from the face. But when the body of the tooth is affected, electrization is of no uſe; for it ſeldom or never relieves the diſorder, and ſometimes increaſes the pain to a prodigious degree.

Swellings in general, which do not contain any *matter*, are generally cured by drawing the electric fluid with a wooden point.

point*. The operation ſhould be continued for three or four minutes every day.

Inflammations of every ſort are generally relieved by a very gentle electrization.

In inflammations of the eyes, the throwing of the electric fluid by means of a wooden point, is conſtantly attended with great benefit; the pain being quickly abated, and the inflammation being generally diſſipated in a few days. In theſe caſes, the eye of the patient muſt be kept open, and care ſhould be taken not to bring the wooden point very near it. Sometimes it is ſufficient to throw the fluid with a metal point; for in theſe caſes, too great an irritation ſhould be always avoided. It is not neceſſary to continue this operation for three or four minutes without intermiſſion; but, after throwing the fluid for about half a minute, a ſhort time may be allowed to the patient to reſt, and to wipe his tears, which generally flow very copiouſly; then the operation may be continued again for another half minute, and ſo on for four or five times every day.

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* It is very remarkable, that in ſome caſes of white ſwellings, quite cured by means of electricity, even the bones and cartilages were in ſome meaſure disfigured.

The *gutta ſerena* has been often cured by electrization; but at the ſame time it muſt be confeſſed, that to my certain knowledge, electricity has proved ineffectual in many ſuch caſes, in which it was adminiſtered for a long time, and with all poſſible attention. I do not know that ever any body was worſted by it. The beſt method of adminiſtring electricity in ſuch caſes, is firſt to draw the electric fluid with a wooden point for a ſhort time, and then to ſend about half a dozen ſhocks of one-twentieth of an inch from the back and lower part of the head to the forehead, very little above the eye.

A remarkable diſeaſe of the eyes was ſome time ago perfectly cured by electrization; it was an opacity of the vitreous humour. This ſeems to be the only caſe of the kind, to which electricity was applied.

All the caſes of *fiſtula lacrymalis*, as far as I am informed, that have been electrified by perſons of ability for a ſufficient time, have been intirely cured. The method generally practiſed, has been that of drawing the fluid with a wooden point, and to take very ſmall ſparks from the part. The operation may be continued for about three or four minutes every day. It is remarkable that in thoſe caſes, after curing the fiſtula lacrymalis, no other diſeaſe was occaſioned by it, as blindneſs, inflammations, &c. by ſuppreſſing that diſcharge.

Palſies are ſeldom perfectly cured by means of electricity, eſpecially when they are of long ſtanding and the intellect is affected; but they are generally relieved to a certain degree. The method of electrifying in thoſe caſes, is to draw the fluid with the wooden point, and to draw ſparks through flannel, or through the uſual coverings of the part, if they are not too thick. The operation may be continued for about five minutes *per* day.

Ulcers, or open ſores of every kind, even of a long ſtanding, are generally diſpoſed to heal by electrization. The general effects are a diminution of the inflammation, and at firſt a promotion of the diſcharge of properly formed matter; which diſcharge gradually leſſens, according as the limits of the ſore contract, till it is quite cured. In theſe caſes the gentleſt electrization muſt be uſed, in order to avoid too great an irritation, which is generally hurtful. To draw or throw the fluid with a wooden or even with a metal point, for three or four minutes *per* day, is quite ſufficient.

Cutaneous eruptions have been ſucceſsfully treated with electrization; but in theſe caſes it muſt be obſerved, that if the wooden point is kept too near the ſkin, ſo as to cauſe any conſiderable irritation, the eruption will ſometimes be cauſed to ſpread more; but if the point be kept at about ſix inches diſtance, or farther, if the electrical machine is very powerful, the eruptions will be gradually diminiſhed, till they are quite cured. In this kind of diſeaſe, the immediate and general effect of the wooden point, is to occaſion a warmth about the electrified part, which is always a ſign that the electrization is rightly adminiſtered.

The application of electricity has perfectly cured various caſes of *St. Vitus's Dance*, or of that diſeaſe which is commonly called ſo; for it is the opinion of ſome very learned phyſicians, that the real diſeaſe called St. Vitus's Dance, which formerly was more frequent than it is at preſent, is different from that which now goes under that name. In this diſeaſe, ſhocks of about one-tenth of an inch may be ſent through the body in various directions, and alſo ſparks may be taken. But if this treatment proves very diſagreeable to the patient, then the ſhocks muſt be leſſened, and even omitted; inſtead of which, ſome other more gentle applications muſt be ſubſtituted.

Scrophulous tumors, when they are juſt beginning, are generally cured by drawing the electric fluid with a wooden or metal point from the part. This is one of thoſe kinds of diſeaſes in which the action of electricity requires particularly the aid of other medicines, in order to effect a cure more eaſily; for ſcrophulous affections generally accompany a great laxity of the habit, and a general cachexy, which muſt be obviated by proper remedies.

In *cancers*, the pains only are moſtly alleviated by drawing the electric fluid with a wooden or metal point. I know of one caſe only, in which a moſt confirmed cancer of very long ſtanding, on the breaſt of a lady, has been much reduced in ſize. It is remarkable, that this patient was ſo far relieved by drawing the fluid with a metal point from the part, that the excruciating pains ſhe had ſuffered for many years, did almoſt intirely diſappear; and alſo, that when the electric fluid was drawn by means of a wooden point, the pains did rather increaſe. This perſon is ſtill under the application of electricity; and the cancer ſeems not unlikely to be perfectly cured, although contrary to the expectations even of the judicious phyſician who electrifies her, and who knows too well the nature of that dangerous diſeaſe.

Abſceſſes, when they are in their beginning, and in general whenever there is any tendency to form matter, electrization diſperſes them. Lately, in a caſe in which matter was formed upon the hip, called the *lumbar abſceſs*, the diſeaſe was perfectly cured by means of electricity. The *ſciatica* has alſo been often cured by it. In all ſuch caſes, the electric fluid muſt be ſent through the part by means of two directors applied to oppoſite parts, and in immediate contact either with the ſkin, or with the coverings, when theſe are very thin. It is very remarkable, that the mere paſſage of the electric fluid in this manner, is generally felt by the patients afflicted with thoſe diſorders, nearly as much as a ſmall ſhock is felt by a perſon in good health. Sometimes a few ſhocks have been alſo given, but it ſeems more proper to omit them; becauſe ſometimes, inſtead of diſperſing, they rather accelerate the formation of matter.

In caſes of *pulmonary inflammations*, when they are in the beginning, electrization has ſometimes been beneficial; but in confirmed diſeaſes of the lungs, I do not know that it ever afforded any unqueſtionable benefit; however, it ſeems that in ſuch caſes the power of electricity has been but ſeldom tried.

Nervous head-achs, even of a long ſtanding, are generally cured by electrization. For this diſeaſe, the electric fluid muſt be thrown with a wooden, and ſometimes even with a metal point, all round the head ſucceſſively. Sometimes exceedingly ſmall ſhocks have been adminiſtered; but theſe can ſeldom be uſed, becauſe the nerves of perſons ſubject to this diſeaſe are ſo very irritable, that the ſhocks, the ſparks, and ſometimes even the throwing the electric fluid with a wooden point kept very near the head, throws them into convulſions.

The application of electricity has often been found beneficial in the *dropſy*, when juſt beginning, or rather in the tendency to a dropſy; but it has never been of any uſe in advanced dropſies. In ſuch caſes, the electric fluid is ſent through the part, in various directions, by means of two directors, and ſparks are alſo drawn acroſs the flannel or the cloaths; keeping the metal rod in contact with them, and ſhifting it continually from place to place. This operation ſhould be continued at leaſt ten minutes, and ſhould be repeated once or twice a day.—Perhaps in thoſe caſes, a ſimple electrization, (viz. to inſulate the patient, and to connect it with the prime conductor whilſt the machine is in action) continued for a conſiderable time, as an hour or two, would be more beneficial.

The *gout*, extraordinary as it may appear, has certainly been cured by means of electricity, in various inſtances. The pain has been generally mitigated, and ſometimes the diſeaſe has been removed ſo well as not to return again. In thoſe caſes, the electric fluid has been thrown by means of a wooden point, although ſometimes, when the pain was too great, a metal point only has been uſed.

Agues very ſeldom fail of being cured by electricity, ſo that ſometimes one electrization, or two, have been ſufficient. The moſt effectual and ſure method has been that of drawing ſparks through flannel, or the cloaths, for about ten minutes, or a quarter of an hour. The patients may be electrified either at the time of the fit, or a ſhort while before the time in which it is expected.

The ſuppreſſion of the menſes, which is a diſeaſe of the female ſex, that often occaſions the moſt diſagreeable and alarming ſymptoms, is ſucceſsfully and ſpeedily cured by means of electricity, even when the diſeaſe is of long ſtanding, and after the moſt powerful medicines uſed for it have proved ineffectual. The caſes of this ſort, in which electrization has proved uſeleſs, are ſo few, and the ſucceſsful ones ſo numerous, that the application of electricity for this diſeaſe, may be juſtly conſidered as an efficacious and certain remedy. Great attention and knowledge is required, in order to diſtinguiſh the arreſt of the menſes from a ſtate of pregnancy. In the former, the application of electricity, as we obſerved above, is very beneficial; whereas in the latter, it may be attended with very diſagreeable effects; it is therefore a matter of great importance to aſcertain the real cauſe of the diſeaſe, before the electricity be applied in thoſe caſes. Pregnant women may be electrified for other diſeaſes, but always uſing very gentle means, and directing the electric fluid through other parts of the body, diſtant from thoſe ſubſervient to generation. In the real ſuppreſſion of the menſes, ſmall ſhocks, i. e. of about one-twentieth of an inch, may be ſent through the pelvis; ſparks may be taken through the cloaths from the parts adjacent to the ſeat of the diſeaſe; and alſo the electric fluid may be tranſmitted by applying the metallic or wooden extremities of two directors to the hips, in contact with the cloaths; part of which may be removed in caſe they are too thick.

Thoſe various applications of electricity ſhould be regulated according to the conſtitution of the patient. The number of ſhocks may be about twelve or fourteen. The other applications may be continued for two or three minutes; repeating the operation every day. But either ſtrong ſhocks or a ſtronger application of electricity, than the patient can conveniently bear, ſhould be carefully avoided; for by thoſe means, ſometimes more than a ſufficient diſcharge is occaſioned, which is not eaſily cured. In caſes of uterine hæmorrhages, I don't know that the application of electricity was ever beneficial, neither that it has been often tried.—Perhaps a very gentle electrization, as to keep the patient inſulated and connected with the prime conductor, whilſt the electrical machine is in action, may be of ſome benefit.

In reſpect to *unnatural diſcharges* and *fluxes* in general, it may be obſerved, that ſome diſcharges are quite unnatural or adventitious, as the fiſtula lacrymalis, and ſome ſpecies of the venereal diſeaſe; but others are only increaſed natural diſcharges, ſuch as the menſes, perſpiration, &c. Now the power of electricity, in general, has been found more beneficial for the firſt, than for the ſecond ſort of diſcharges, which are moſtly increaſed by it.

In the *venereal diſeaſe* electrization has been generally forbidden; having moſtly increaſed the pains, and other ſymptoms, rather than diminiſhed them. Indeed, conſidering that any ſort of ſtimulus has been found hurtful to perſons afflicted with that diſorder, it is no wonder that electricity has produced ſome bad effects, eſpecially in the manner it was adminiſtered ſome time ago, viz. by giving ſtrong ſhocks. However, it has been lately obſerved, that a very gentle application of electricity, as drawing the fluid by means of a wooden or metal point, is peculiarly beneficial in various caſes of this kind, even when the diſeaſe has been of long ſtanding. Having remarked above, that tumors, when juſt beginning, are diſperſed, and that unnatural diſcharges are gradually ſuppreſſed by a judicious electriza-

tion;

tion; it is ſuperfluous to deſcribe particularly thoſe ſtates of the venereal diſeaſe in which electricity may be applied; it is only neceſſary to remind the operator to avoid any conſiderable ſtimulus in caſes of this ſort.

The application of electricity has been found alſo beneficial in other diſeaſes beſides thoſe mentioned above; but as the facts are not ſufficiently numerous, ſo as to afford the deduction of any general rules, I have not thought proper to take any particular notice of them; eſpecially becauſe the effects of electricity on the human body in various circumſtances, have been already ſufficiently conſidered under general and comprehenſive heads.

We may laſtly obſerve, that in many caſes, the help of other remedies to be preſcribed by the gentlemen of the faculty, is required to aſſiſt the action of electricity, which by itſelf would perhaps be uſeleſs; and on the other hand, electrization may often be applied to aſſiſt the action of other remedies, as of ſudorifics, ſtrengthening medicines, &c.

"While I was writing ſome of the "above caſes," ſays Mr. Becket, "an "obſervation or two occurred to me; "which, though perhaps of no great con-"ſequence, may not be amiſs to men-"tion, as every particular effect of elec-"tricity ſeems to be worthy of notice.

"One circumſtance attending ſome of "the preceding cures, particularly that "of the *paralytic*, related by Mr. Jones, "was a freſh and copious diſcharge of the "*bliſters*, which had been previouſly ap-"plied to the patients.—This, I think, "ſeems to be a pretty general conſequence "of electrification; at leaſt, I have myſelf "known many inſtances of it; particu-"larly in one gentleman, whom I elec-"trified for a paralytic complaint, and "who had a bliſter applied to the back "part of his neck. He informed me, "that, in the night after his being elec-"trified the preceding day, he found a "much more copious diſcharge from the

" bliſter than at other times; though the " operation was no more than his ſtanding, for about a quarter of an hour, on " the inſulated ſtool, while ſparks were " drawn from the ſide of his face. " From hence it appears not impoſſible, " that, in ſome caſes, bliſters may be attended with peculiar benefit, during a " courſe of electrical treatment; in others, " perhaps, it might be worth while to " make uſe of electricity, merely to obtain a favourable diſcharge from the " bliſters."

Authentic phyſical caſes, in which Electricity was adminiſtered.

CASE I.

The particulars of the following caſe were communicated to me by Mr. Partington.

Daniel Wiſcoyl, aged thirty-ſix, of a ſtrong robuſt conſtitution, was ſent from the Weſtminſter Diſpenſary, in Gerard-ſtreet, to Mr. Partington, in order to be electrified for a violent inflammation in both his eyes. The account he gave of his diſorder, was the following:—Several dark objects of different ſhapes and ſizes, ſeemed at firſt to obſtruct his ſight. This was ſucceeded by an inflammation in both his eyes, which increaſed with ſuch rapidity, that in a week's time he was brought to the degree of blindneſs that afflicted him till he was electrified. He was immediately recommended to the Weſtminſter Diſpenſary, where every poſſible attention was paid to his misfortune by Mr. Ford, the ſurgeon of that place; but the obſtinacy of the diſorder was ſuch, that every endeavour made towards the relief of this poor man, proved uſeleſs.—Bliſters and leeches, beſides the other uſual means, were applied without any efficacy whatever.

About two months after the commencement of the inflammation, Mr. Ford recommended him to Mr. Partington; who, on examining him, found that the eyelids could not be opened without the help of the fingers, and that when opened, the coats of the eye appeared of an uniform red colour. The ſight of the right eye, which was the moſt affected, was ſo far impaired, that when it was turned towards a window, the eye-lids being forced open, he could perceive only a red glare of light like a ball of fire; but the reſt of the room ſeemed to be equally dark, ſo that he could not diſtinguiſh any object in it. With the left eye he could diſtinguiſh colours, and the ſhapes of objects that were held to him, but in their ſizes he was commonly miſtaken. This diſorder was accompanied with excruciating pains, ſhifting from one part to the other, but principally inſiſting on his temples, and ſometimes darting to the back part of his head, or to the center of his eyes.

Mr. Partington began to electrify him the 21ſt of October, 1776; and three days after the inflammation began viſibly to abate, and in a fortnight's time it was quite ſubſided; but the pupil of the eye was ſo nearly cloſed, that ſcarce any of it could be ſeen. He continued to be electrified every day for five weeks, and the pupil gradually dilated, till he attained a degree of ſight ſufficient to diſtinguiſh objects on the other ſide of the way. The pains had now intirely left him, ſo that he omitted the uſe of electricity, and did not experience any farther inconvenience after it.

This remarkable cure was effected by throwing the ſtream of electric fluid with a metal, and with a wooden point. The firſt inſtrument uſed, which was contrived by the late Mr. Ferguſon, conſiſted in a pointed braſs wire, faſtened by means of a cork at the ſmaller end of a conical glaſs, open at both ends, and paſſing through the axis of this conical or funnel-like glaſs, its point came within about half an inch of the larger aperture of the glaſs. This inſtrument being deſigned to throw the electric fluid upon the eye, was to be fixed ſo that the larger aperture of the glaſs ſurrounding the eye, kept its lids open, and the point of the wire was oppoſite to the pupil, and about half or one inch from it. With this inſtrument it was obſerved that a ſpark often proceeded from the point of the wire, which occaſioned an inſufferable pain; for which reaſon Mr. Partington, who ſpares no pains to advance this branch of phyſic, thought of improving this inſtrument by fixing a wooden point upon the pointed wire, by which means, the former inconvenience was entirely removed, and the ſtream of electric fluid was rendered more efficacious, and more eaſily manageable.

This, as far as I am informed, was the firſt time that this moſt excellent method of throwing the electric fluid, viz. with a wooden point, was uſed.

N. B. The directors deſcribed in the preceding pages, the principal of which were contrived by Mr. Partington, anſwer every required purpoſe, much better than the above-deſcribed inſtrument of Mr. Ferguſon.

CASE II.

The following caſe is related by Mr. Lovett, in his *Electricity rendered uſeful*:

"Having obſerved the great efficacy of the electrical æther, in ſoon relieving moſt kinds of inflammations, I was inclined to think the ſame ſalutary effects would appear when applied to the St. Anthony's Fire; but when a caſe of that ſort offered, the inflammation was ſo great, that at firſt ſight I almoſt deſpaired of ſucceſs.

" About the middle of the day I made the firſt trial, and before night the ſwelling was much abated, and in a few days quite cured.

" The operation was ſimply drawing ſparks with a finger, or an iron ſtyle, while the perſon was electrified on the inſulating ſtool."

CASE III.

The following caſe is alſo related by Mr. Lovett:

" Anne Thompſon, in Little Fiſh-ſtreet, Worceſter, was troubled with a fiſtula near the inner corner of her eye, which broke out, and healed, no leſs than ſeven times. The laſt time it healed, it continued well for ſome time; after which it began with a ſmall ſwelling, and continued growing larger, till it was as big as a filbert; when ſhe was adviſed to try electricity. After the ſwelling was electrified, it ſoon decreaſed, till it was intirely diſperſed; and has continued well for more than two years, without the leaſt ſymptom of any return of the diſorder. — The operation was ſimply drawing ſparks from the part affected."

CASE IV.

The late Mr. Ferguſon being at Briſtol, was ſeized with a violent ſore throat, ſo that he could not ſwallow any thing. Being willing to try the power of electricity, Mr. Adlam, of that city, performed the operation; which was merely drawing ſparks from the throat. The electrization was repeated half an hour after, and was attended with ſo good and remarkable an effect, that in about one hour's time Mr. Ferguſon could both eat and drink without pain.

CASE V.

The following two caſes are related by Mr. John Birch, Surgeon.

"A young woman, at the age of twenty-two, deſired my advice for a tumor on her thigh, which followed an unhappy accident ſhe met with two years before. Her caſe was attended with many complicated ſymptoms, and, among them, a ſuppreſſion of the menſes, which had laſted ſeven months. I thought it right to relieve, if poſſible, this ſymptom, before I proceeded to perform the operation, which was neceſſary for the tumor.

"For three ſucceſſive days I paſſed ſome electric ſhocks through the region of the pelvis; and on the fourth, ſhe was attacked with a violent pain in her ſide, which left her on applying the ſhocks to that part. In about three hours it returned, and I was ſent for. I repeated the ſhocks, and the pain again vaniſhed. I viſited her ſix hours after, when the pain had begun to attack the ſide.—I paſſed a ſtronger ſhock, which removed it, and ſhe ſlept well the whole night.—The next day, being the fifth, the menſes appeared, and flowed gently for three days; but ceaſing then, the pain of the ſide returned, and was ſo violent, that I was ſent for in a hurry.—When I came to her, I found her in great agony; but being informed of the cauſe, I begged to make trial of electricity once more, which ſhe readily conſented to, as ſhe had experienced ſuch inſtantaneous relief before.—On its application, the pain ceaſed.—A very ſhort time after, the flux came on, and continued two days.—I attended her for ſeveral weeks after, upon the former account, and had the pleaſure to ſee her recover from all her complaints."

CASE VI.

" I was ſent for to a lady, who had been afflicted with painful ulcers on both her legs, for more than fifteen months.—They came after a lying-in, and had never healed. The legs were ſwelled, but the ulcers had no malignant appearance.—She told me, that ſince her laſt miſcarriage, which was then more than ten months, ſhe had never been regular.—She attributed the pain and ſwelling of her legs to that cauſe; and upon enquiry, I found that ſhe was ſenſible of an endeavour of nature to relieve herſelf at regular periods, and that the pain ſhe ſuffered at thoſe times, was alleviated by a bloody diſcharge from the ulcers.—I applied the proper dreſſings and bandages to the parts, and waited the approach of that period. In about ten days, a pain ſeized her back, and ſhe began to complain of her legs: I then electrified her; and the next day ſhe was taken out of order, and continued ſo the whole week.—The ulcers mended from that time, and were healed in three weeks afterwards."

The reader may reſt aſſured, that caſes of this ſort are ſo frequent, that perhaps electricity may be conſidered as a ſure, and indeed as the only ſure remedy for the arreſt of the menſes.

CASE VII.

The following caſe is extracted from the LXVIIIth vol. of the Philoſophical Tranſactions.

A cure of a muſcular contraction by electricity. By Mr. MILES PARTINGTON, *in a letter to* WM. HENLY, F. R. S.

" *Great Ruſſel-ſtreet, June* 13, 1777.

" DEAR SIR,

" It is ſome time ſince, you informed " me that you had mentioned to Sir John " Pringle, Miſs Lingfield's cure by elec" tricity; that it excited his attention; " and that it was his opinion, that the " communication of it to the Royal So" ciety would be deemed important and " uſeful. I hope you will not blame my " delay in the compliance with your re" queſt. I have waited for no other pur" poſe, than to obtain the lateſt account " of the permanency of thoſe good ef

" fects, which ſhe had then but recently
" experienced, from our electrical experi-
" ments upon her. Of theſe advantages
" we have both had repeated confirma-
" tion; and I may now, I believe, with
" ſtrict propriety, from the notes I made
" for my own ſatisfaction, ſubmit the fol-
" lowing particulars of them, to the in-
" ſpection of whomſoever your judgment
" ſhall direct, or to appropriate them to
" any other purpoſe you pleaſe. As you
" were preſent when I firſt waited on this
" unhappy young lady, you will recollect
" the condition in which we found her.
" Her head was drawn down over her
" right ſhoulder; the back part of it was
" twiſted ſo far round, that her face
" turned obliquely towards the oppoſite
" ſide, by which deformity ſhe was diſ-
" abled from ſeeing her feet, or the ſteps,
" as ſhe came down ſtairs. The *ſterno-*
" *moſtoideus* muſcle was in a ſtate of con-
" traction and rigidity. She had no ma-
" terial pain on this ſide of her neck;
" but, owing to the extreme tenſion of
" the teguments of the left ſide, ſhe had

" a pain continually, and often it was very " violent, particularly in ſudden changes " of the weather. Her pulſe was weak, " quick, and irregular. She was ſubject " to a great irritability; had frequently " a little fever, which came on of an " evening, and left her before morning; " her ſpirits were generally exceedingly " oppreſſed; and at times ſhe was ſlightly " paralytic.

" She dated the origin of her diſorder " at ſomething more than two years " from that period. She was ſuddenly " ſeized, going out of a warm room into " the cold air, with a pain upon the back " of her head, which admitted of ſmall " abatement for ſome months, contracting " gradually the muſcles to the melancholy deformity we then beheld; and " notwithſtanding every prudent means " had been uſed to ſubdue it, and ſhe " ſtrictly adhered to every article preſcribed to her by the faculty, ſhe was " ſenſible of little variation ſince, and " that rather on the unfavourable ſide.

"I urged her to make a trial of electricity. She was willing while ſhe "was in London to try the experiment; "and though the weather was remark"ably tempeſtuous, ſhe came to me the "firſt tolerable day, and was electrified "the firſt time February 18, 1777.

"I ſat her in an inſulated chair, and, "connecting it by a chain to the prime "conductor of a large electrical machine, "I drew ſtrong ſparks from the parts af"fected, for about four minutes, which "brought on a very profuſe perſpiration "(a circumſtance ſhe had been unaccuſ"tomed to) which ſeemed to relax the "*moſtoideus* muſcle to a conſiderable de"gree; but as the ſparks gave her a good "deal of pain, I deſiſted from drawing "them, and only ſubjected her a few "minutes longer to the admiſſion of the "fluid, which paſſed off without inter"ruption from the pores of her ſkin and "adjacent parts. The next time ſhe "came to me, was the 24th of the ſame "month. As ſhe had been in the after"noon of the firſt day's experiment, a

" good deal diſordered, I changed the " mode of conducting, and ſat her in a " common dining chair, while I dropped, " for five minutes, by the means of a " large diſcharging rod with a glaſs " handle, very ſtrong ſparks upon the " *moſtoideus* muſcle, from its double origin at the *ſternum* and *clavicula* to its " inſertion at the back of the head. She " bore this better than before, and the " ſame good effect followed in a greater " degree, and without any of the ſubſequent inconveniences. I ſaw her the " third time on the 27th. She aſſured " me ſhe had eſcaped her feveriſh ſymptoms on an evening, and that her ſpirits were raiſed by the proſpect of " getting well; that ſince the laſt time " I electrified her, ſhe had more freedom " in the motion of her head, than ſhe had " ever experienced ſince the firſt attack of " her diſorder. I perſiſted in electrifying " her after the ſame manner, March 3d, " 5th, 6th, 7th, and 9th; from each time " ſhe gained ſome advantage, and her feveriſh tendency and nervous irritability " went off entirely.

"The weather now ſetting in very un-
"favourable, and fearful of loſing the
"advantages we had happily reaped from
"our early efforts, I requeſted the favour
"of you, as the next-door neighbour, to
"electrify her every evening, while ſhe
"was in town, and ſhe might, if any al-
"teration took place, ſee me occaſionally.
"Fortunately for her, you accepted the
"propoſal; and to your judgment and
"caution in the conduct of it, for the
"next fortnight (three evenings only ex-
"cepted) you brought about the happy
"event; and have received her teſtimony
"of gratitude, for relieving her from a
"condition, under which life would not
"be deſirable, to a comfortable aſſociation
"with her family and friends.

"I am, &c."

"The method I purſued was, to place the lady upon a ſtool with glaſs legs, and to draw ſtrong ſparks, for at leaſt ten minutes, from the muſcles on both ſides of her neck. Beſides this, I generally gave her two ſhocks, from a bottle, containing fifteen ſquare inches of coated ſurface, fully charged, through her neck and one of her arms, croſſing the neck in different directions. This treatment ſhe ſubmitted to with a proper reſolution; and it gave me ſincere pleaſure to find it attended with the deſired ſucceſs.

W. HENLY."

CASE VIII.

The following caſe is extracted from the LXIXth vol. of the Philoſophical Tranſactions.

An account of a cure of the St. Vitus's Dance, by electricity. In a letter from ANTHONY FOTHERGILL, M. D. F. R. S. *at* Northampton, *to* W. HENLY, F. R. S.

Northampton, Oct. 28, 1778.

SIR,

Agreeable to my promiſe, I now proceed to give you ſome account of a recent cure performed by electricity, which will, I think, afford you much pleaſure.

Ann Agutter, a girl of ten years of age, of a pale emaciated habit, was admitted an out-patient at the Northampton Hoſpital on the 6th of June laſt. From her father's account it appeared (for ſhe was ſpeechleſs, and with difficulty ſupported from falling by two aſſiſtants) that ſhe had for ſix weeks laboured under violent convulſive motions, which affected the whole frame, from which ſhe had very ſhort intermiſſions, except during ſleep; that the diſeaſe had not only impaired her memory and intellectual faculties, but of late had deprived her of the uſe of ſpeech.

Volatile and fetid medicines were now recommended, and the warm bath every other night, but with no better ſucceſs, except that the nights which had been reſtleſs, became ſomewhat more compoſed. Bliſters and anti-ſpaſmodics were directed, and particularly the flowers of zinc, which were continued till the beginning of July, but without the leaſt abatement of the ſymptoms; when her father growing impatient of fruitleſs attendance at the hoſpital, I recommended, as a dernier re-ſort, a trial of electricity, under the management of the Rev. Mr. UNDERWOOD, an ingenious electrician. After this I heard no more of her till the firſt of Auguſt, when her father came to inform me that his daughter was well, and deſired ſhe might have her diſcharge. To which, after expreſſing my doubts of the cure, I conſented; but ſhould not have been perfectly convinced of it, had I not received afterwards a full confirmation of it from Mr. Underwood, dated September 16; an extract from whoſe letter I will now give you in his own words.

" I have long expected the pleaſure of
" ſeeing you, that I might inform you
" how I proceeded in the cure of the poor
" girl. As the caſe was particular, I
" have been very minute, and wiſh you
" may find ſomething in it that may be
" uſeful to others. If you think it pro-
" per, I beg you will ſtate the caſe medi-
" cally, and make it as public as you
" pleaſe.

" July 5. On the glaſs-footed ſtool
" for thirty minutes: ſparks were drawn
" from the arms, neck, and head, which
" cauſed a conſiderable perſpiration, and
" a raſh appeared in her forehead. She
" then received ſhocks through her hands,
" arms, breaſts, and back; and from this
" time the ſymptoms abated, her arms
" beginning to recover their uſes*.

" July 13. On the glaſs-footed ſtool
" forty-five minutes: received ſtrong
" ſhocks through her legs and feet,
" which from that time began to recover their wonted uſes; alſo four ſtrong
" ſhocks through the jaws, ſoon after
" which her ſpeech returned.

" July 23. On the glaſs-footed ſtool for
" the ſpace of one hour: ſparks were
" drawn from her arms, legs, head, and
" breaſt, which for the firſt time ſhe very
" ſenſibly felt; alſo two ſhocks through
" the ſpine. She could now walk alone;
" her countenance became more florid,
" and all her faculties ſeemed wonderfully

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* The coated bottle held near a quart.

" ſtrengthened; and from this time ſhe " continued mending to a ſtate of perfect " health.

" Every time ſhe was electrified poſi- " tively, her pulſe quickened to a great " degree, and an eruption, much like the " itch, appeared in all her joints."

Thus far Mr. Underwood. To complete the hiſtory of this ſingular caſe, I this day (Oct. 28) rode ſeveral miles, on my return from the country, to viſit her; and had the ſatisfaction to find her in good health, and the above account verified in every particular; with this addition, that at the beginning of the diſeaſe, ſhe had but ſlight twitchings, attended with running, ſtaggering, and a variety of involuntary geſticulations, which diſtinguiſh the St. Vitus's Dance; and that theſe ſymptoms were afterwards ſucceeded by convulſions, which rendered it difficult for two aſſiſtants to keep her in bed, and which ſoon deprived her of ſpeech and the uſe of her limbs. The eruptions which appeared on the parts electrified ſoon receded, without producing any return of the ſymptoms, and therefore could not be called critical, but merely the effect of the electrical ſtimulus. Having given her parents ſome general directions as to her regimen, &c. I took my leave, with a ſtrong injunction to make me acquainted, in caſe ſhe ſhould happen to relapſe. Before I conclude, it may not be improper to obſerve, that ſome time ago, I was fortunate enough to cure a boy who had long had the St. Vitus's Dance (though in a much leſs degree) by electricity. A violent convulſive diſeaſe, ſomewhat ſimilar to the above, though, if I recollect right, not attended with the *aphonia*, was ſucceſsfully treated in the ſame way by Dr. Watſon, and is recorded in the Philoſophical Tranſactions. May we not then conclude, that theſe facts alone, and more might perhaps be produced, are ſufficient to intitle electricity to a diſtinguiſhed place in the claſs of anti-ſpaſmodics?

I am, &c.

CASE IX.

In my Treatiſe on Electricity, publiſhed ſome time ago, I related only two caſes of medical electricity; one of which was attended with bad, and the other with very good effects. I think it proper to ſubjoin them here.

The following caſe was related by Dr. Hart of Shrewſbury. See the Philoſophical Tranſactions, Vol. XLVIII.

A girl, aged about ſixteen, whoſe right arm was paralytic, being electrified the ſecond time, became intirely paralytic, and remained in that ſtate for about a fortnight; then the ſuperadded paraliſy was removed, by means of ſome medicines; but the arm which was before paralytic, remained ſo. It ſhould be alſo added, that this arm was very much waſted in compariſon to the other. Notwithſtanding the firſt bad accident, it was reſolved to make another trial of electricity. But after uſing this treatment for three or four days, ſhe became again univerſally paralytic, and even loſt her voice, and could ſwallow with difficulty. This ſecond accident plainly ſhewed the bad effects of electricity in that caſe, and the girl, although afterwards relieved of her additional paraliſy, remained in the ſame ſtate ſhe was before the uſe of electricity.

In this caſe, it is ſuſpected that electricity was improperly managed; at that time it being uſual to give ſtrong ſhocks, which perhaps were pernicious in the above-mentioned caſe.

CASE X.

The following caſe was performed under the direction of the learned Dr. Wm. Watſon, F. R. S.

A girl belonging to the foundling-hoſpital, aged about ſeven years, being firſt ſeized with a diſorder occaſioned by the worms, was at laſt, by an univerſal rigidity of the muſcles, reduced to ſuch a ſtate, that her body ſeemed rather dead than alive. After that other medicines had been ineffectually adminiſtered for about one month, ſhe was at laſt electrified intermittedly for about two months, after which time ſhe was ſo far recovered, that ſhe could, without pain, exerciſe every muſcle of her body, and perform every action as well as before ſhe had the diſtemper.

The intelligent reader muſt have undoubtedly remarked, that in ſome of the above caſes, the electrization adminiſtered was rather ſtrong, and different from the general rules given previous to the narration of the caſes. But it muſt be obſerved, that ſome of the above caſes happened before the principal methods of electrifying, which are now uſed by the beſt practitioners, were introduced.—Perhaps, in ſimilar caſes, the ſame ſalutary event might be produced by a more gentle electrization.

A Letter

A Letter from Mr. MILES PARTINGTON *to the Author.*

Cavendiſh Square, Auguſt the 10*th*, 1781.

SIR,

As the poſſibility of a cure of a fiſtula lacrymalis by electricity has been publicly queſtioned, I am very glad to comply with your requeſt, in ſtating the ſucceſsful treatment of a diſeaſe of this kind under my own inſpection.

Ann Woodward between 20 and 30 years of age, was recommended to my care by Mrs. Swift, of King Street, Bloomſbury, in whoſe ſervice ſhe then lived.—I was told ſhe had a fiſtula lacrymalis, which had reſiſted every attempt to relieve her. I ſhall deſcribe the ſituation ſhe was in when I firſt ſaw her, and ſhall add her own account anterior to that period. There was a very violent inflammation in the left eye, attended with exceſſive pain, and almoſt continual flux of tears down the cheek, the ſharpneſs of which had conſiderably excoriated the ſkin. A little prominence was perceivable on the inner angle of the eye, from which might be generally preſſed a ſmall quantity of matter. The inflammation had been kept up with little abatement for ſix months, during which time a cooling regimen had been particularly enjoined her, and was ſtrictly complied with. Since the inflammation became violent, ſhe had conſtantly awoke in pain, which laſted till twelve o'clock at noon, and was then tolerably eaſy the reſt of the day. She told me, that ſhe had, as long as ſhe remembered, been ſubject to a weak and watery eye, but it had never given her much concern, till ſhe received a cold in it upon her coming to London. In every other reſpect ſhe was remarkably healthy.

My firſt object was to relieve her of the pain. For this purpoſe I conveyed the electric fluid from a wooden point, which generally at the time blunted the acuteneſs of the ſenſation; but which, if by bringing it near to her eye the fluid was concentrated, it always increaſed it to a great degree, though this went off by being left to itſelf, or repeating the milder method. I continued in this courſe of treatment for three weeks, when the inflammation was nearly ſubſided, and the pain entirely gone away. Still perceiving the matter to ooze from the inner angle, I ventured to paſs a ſingle electric ſhock down the duct of the noſe, which I effected by placing one of the directors upon the lacrymal ſac, and the other up the noſtril, for the convenience of a more immediate local conveyance. This gave her much pain after the operation, and it remained all the reſt of the day. I found in the morning that ſhe could hardly bear me to preſs upon the ſac, and very little matter came from it. I then paſſed four ſhocks, in the ſmalleſt degree I could convey them, and to be felt, which were not attended with ſo much pain. At bedtime there came on a great throbbing in the part, and in the courſe of the night a large quantity of matter burſt down the noſtril, and ſhe was immediately eaſy. Some matter continued to come away for about four days, and ſhe appeared to be perfectly well. Her eye has been ſince in a ſtronger ſtate than it ever was before.

If this ſhould ſtill want additional ſtrength, I am willing to give you farther inſtances of relief in this diſeaſe by electricity, though they have not been ſo effectually cured.

I ſhall now add a few obſervations, which may perhaps merit your notice. In order to increaſe the power of electrization, I have added a very large coated jar to the prime conductor of my electrical machine. This jar is placed upon a mahogany ſtand, ſo that the knob of it touches the conductor. The inſulated chair is alſo in contact with the ſaid conductor, and the patient is ſeated in it as uſual. With this diſpoſition of the apparatus, the wheel of the machine is firſt turned a few times round; then I apply the metallic rod to the patient, in order to draw the ſparks through the cloaths, or the ſtream of electric fluid by a wooden point, in caſe the diſeaſe ſeems to require ſuch treatment; and I find, that by this means the effects of the electrization are conſiderably increaſed, the pungency of the ſparks is felt much deeper into the electrified part of the body; the heat occaſioned by it is alſo greater, and therefore it ſeems to be more efficacious for internal complaints. Add to this, that the uſual inconvenience of diſſipating the electric fluid into the air is conſiderably prevented.

This diſpoſition of the apparatus does alſo anſwer another purpoſe, which is that of electrifying a patient, without having any aſſiſtant in the room; for after the jar is charged, the turning of the wheel may be diſcontinued and the patient may be fully electrified. No ſhock is to be feared from this apparatus; for, ſince the wooden ſtand upon which the jar is fixed, is a bad conductor, the diſcharge can only be made gradually.

I have made another addition to my directors, or rather have contrived a new director, by which an electrified ſtream of water or other fluid is thrown upon any part of the body. This director conſiſts of a ſmall glaſs tube about 3 inches long, and a quarter of an inch in diameter, one extremity of which is drawn to a very fine point, ſuch as the water can hardly go through. This tube I faſten to an inſulating handle, which being made like a pair of pincers, holds it by the middle; I then pour a little water or other fluid into the tube, and by means of a wire connect it with the prime conductor. When the machine is in motion, the ſtream of water, which the electric fluid forces out of the tube, is very much ſubdivided, and, when directed upon the face, or any naked part of the body, gives an agreeable ſenſation, which proves very refreſhing to patients, eſpecially in caſes of great irritability of the nerves. The ſhort experience I have had of theſe directors does not enable me to determine how far they may be uſeful. I have already ſeen that they do not anſwer my firſt ſanguine expectations; but yet in ſeveral inſtances they ſeem to have afforded conſiderable relief, when other modes of electrization proved uſeleſs.

In the courſe of my practice, I have obſerved a very remarkable effect of electricity upon the human body, which is, that it removes coſtiveneſs in thoſe perſons that are electrified, eſpecially about the ſtomach. It does by no means increaſe the evacuations of ordinary good habits of body, but only reinſtates the uſual diſcharge in caſe of coſtiveneſs. This effect ſeems to take place becauſe the electrization gives vigour and energy to the fibres of the debilitated inteſtines, in the ſame manner as it reſtores the loſt motion of more external muſcles.

I am,
Dear Sir,
Yours, &c.

MILES PARTINGTON.

APPENDIX.

WHILE part of this Work was under the preſs, it was requeſted by ſome of my friends, to add a few Experiments to be performed with the electrical machine, which might ſhew ſome effects of the electric fluid upon the human body. Indeed, to exhibit experiments of this kind upon artificial machines only, without the human body itſelf, when duly conſidered, can hardly be ſuppoſed to afford much light; becauſe the difference between the body of an animal, and the machines which can be made moſt ſimilarly to it, is ſo great, as to produce effects much different, although one would hardly ſuſpect any difference in the mechaniſm. The effects therefore of the electric fluid upon the human body, muſt be abſolutely inveſtigated by experiments upon it, and in ſome meaſure alſo by experiments upon other animals. However, to ſatisfy the curioſity of thoſe gentlemen, I ſhall add in this appendix, a few experiments, which ſhew ſome effects analogous to thoſe produced by electricity upon the human body.—They may divert a leiſure hour, and perhaps may open the way to farther inveſtigations.

EXPERIMENT I.

The Capillary Syphon.

Let a ſmall bucket of metal, full of water, be ſuſpended from the prime conductor, and put in it a ſmall ſyphon, having a very narrow aperture, from which the water will juſt drop into a baſin put at ſome diſtance under it. This ſyphon is beſt made of a piece of ſlender cane.—Fig. 4. repreſents the apparatus for this experiment: A is the prime conductor, B is the metal bucket, generally made of tin, C the ſyphon, and D the baſin, into which the water drops from the ſyphon. In this diſpoſition, if the winch of the machine be turned, the water, which,

when

when not electrified, only dropped from the extremity of the ſyphon, will now run in a full ſtream, which will even be ſubdivided into other ſmaller ſtreams; and if the experiment be made in the dark, it will appear beautifully illuminated.

This experiment may ſhew that perſpiration is promoted by electricity; but it muſt be obſerved, that in general, when electricity is communicated to inſulated veſſels, containing water that is actually running from a pipe, the ſtream will not be always accelerated, but will nearly obſerve the following laws:

" 1. The electrified ſtream, though it " divides and carries the liquid further, " is neither ſenſibly accelerated nor re- " tarded, when the pipe through which " it iſſues, is not leſs than a line in dia- " meter.

" 2. Under this diameter, if the tube " is wide enough to let the liquid run in a " continued ſtream, electricity accelerates " it a little, but leſs than a perſon would

" imagine, if he judged by the number of
" jets which are formed, and by the diſ-
" tance to which they go.

" 3. If the tube be a capillary one,
" from which the water only drops natu-
" rally, the electrified jet not only be-
" comes a continued ſtream, but is alſo
" conſiderably accelerated; and the ſmaller
" the capillary tube is, the greater in
" proportion is the acceleration.

" 4. So great is the effect of the elec-
" tric virtue, that it drives the water in
" a conſtant ſtream out of a very ſmall
" capillary tube, out of which it had not
" before been able even to drop."

In this experiment, whether the electricity is poſitive or negative, viz. whether the bucket with the ſyphon in it, is ſuſpended to the prime conductor, or to the rubber of an ordinary electrical machine, the effect is always the ſame, provided the electrization is equally ſtrong. Indeed, if we conſider the principal electrical phenomena, as the attraction, repulſion, promotion of evaporation, which is certainly a conſequence of the repulſion communicated to the particles of bodies actually evaporating; and in ſhort, conſidering thoſe phenomena, which are produced by electricity upon the human body, and upon the bodies of other animals, we could hardly believe that negative electrization retards the pulſe, contrary to the effect of poſitive electrization, as it has been lately pretended, even ſuppoſing that the direct experiment had not been actually tried.

EXPERIMENT II.

To promote the evaporation of fluids, by means of electricity.

Take two equal pewter plates, and pour in each of them an equal quantity of water, juſt enough to cover their bottoms, and with the help of a pair of ſcales let them be made equal in weight. This done, put one of the plates upon an inſulated ſtool, communicating with the prime conductor of the electrical machine, and ſituate the other plate in ſome other part of the room, where it may be in an equal degree of heat, and equally expoſed to the air as the other plate, but only out of the influence of electricity. Let now the machine be put in action, ſo as to keep the prime conductor, and the plate connected with it, ſtrongly electrified for about half an hour or longer. Then ſtop the machine, and weigh both the plates; it will be found, that the plate which has been electrified is the lighter: hence it is plain, that the electrization has promoted the evaporation of the water contained in it.

The ſame experiment may alſo be made with fruit, with animals, with plants, and in ſhort, with any thing that is actually evaporating; but in ſome ſuch caſes, the electrization ſhould be continued much longer; and alſo other circumſtances ought to be taken into account, in order to render the effect of electricity both ſenſible and certain. This experiment is alſo attended with the ſame effect, whether the electrization is poſitive or negative; hence we have another reaſon to diſbelieve that negative electrization produces any effects upon the human body, different from the poſitive. One Mr. Koeſtlin, who a few years ago publiſhed a diſſertation on the effects of electricity upon ſome organic bodies, pretended to have found, that both animal and vegetable life were retarded by negative electrification; but I do not know whether the experiment was ever repeated by any body elſe. The oddity and diverſity of effects ariſing from experiments apparently ſimilar, is ſuch, that no perſon, converſant with experimental philoſophy, ſhould poſitively affirm any new natural law, that is indicated by a few facts, which are moſtly of a dubious nature; eſpecially when many other conſiderations ſeem to ſhew the improbability of the aſſertion.

EXPERIMENT III.

To ſhew that the fluids of the human body are better conductors of electricity than water.

Take a glaſs tube about one-fortieth of an inch in diameter, and nearly ſix inches long, or rather two ſuch tubes exactly equal in length and diameter, and holding one of them with one extremity in water, let it be filled with that fluid. The water will ſoon fill the tube in virtue of the capillary attraction, eſpecially if the tube be held inclined to the ſurface of the water. After the ſame manner let the other tube be filled with blood, or ſome other fluid of the human body. Now let an electric jar be charged, and the circuit through which the jar is to be diſcharged, let it be formed of one of theſe tubes; to the extremities of which ſlender wires may be fitted ſo as juſt to touch the fluid contained in it, and alſo the arms of a perſon that is deſirous of trying the experiment. In this manner, if the diſcharge of the jar be made ſeveral times, alternately changing the glaſs tube, viz. uſing once that filled with water, then the other filled with blood, and ſo on; it will be found that the ſhock is felt more ſenſibly when the glaſs tube filled with any fluid of the human body forms part of the circuit, than when the tube filled with water is uſed.

The perſon who tries this experiment need not be afraid of the ſhocks, becauſe their force is much weakened by going through the fluid contained in the glaſs tube. Beſides, the ſtrength of the ſhocks ſhould not be greater than that they may be juſt felt. It is only neceſſary to charge the jar always equally high, which is eaſily done by means of Mr. Lane's electrometer, deſcribed in the preceding pages.

After the like manner the degree of conducting power of various ſubſtances may be aſcertained. Thus it may be obſerved, that ſea-water conducts better than freſh water, and that common freſh water conducts better than diſtilled water. The conducting power of ſome powders may be alſo tried in this manner.

EXPERIMENT IV.

To break ſmall glaſs tubes by means of an electric ſhock.

Let ſome glaſs tubes be drawn with the help of a blow-pipe, nearly in the ſhape repreſented by E F, G H, fig. 4. viz. narrow in the middle and larger towards their extremities. The diameter of the middle part ſhould not exceed one-twentieth part of an inch. Fill one of theſe tubes with water, after the manner deſcribed in the preceding experiment, and inſert two ſlender wires through both apertures, the extremities of which within the tube, ſhould come within about one tenth of an inch of each other. — This done, let the diſcharge of an electric jar be made through this tube, viz. by connecting the ring of the wire E with the outſide of the jar, and the ring of the wire F with the inſide of the ſaid jar, that is, with the ring E of the electrometer, fig. 1. and the tube will be broke with conſiderable violence. The ſame effect is produced when the tube is filled with any other liquor inſtead of water.

If the extremities of the wires within the tube are put ſo far from each other, as to exceed the diſtance at which the charge of the jar can leap in the form of a ſpark, then the glaſs tubes will not be broke.

By this experiment we can hardly deduce any inſtruction relative to the ſenſation of the ſhock perceived by a perſon, who forms the circuit in the diſcharge of an electric jar; for we learn by the experiment, that except any ſpark happens within the water, the fineſt and britleſt tube is not broke; and therefore we may conclude, that the concuſſion given to the tube by the ſhock, when the extremities of the wires within it are conſiderably far from each other, is very little, if at all ſenſible.—Farther, it ſeems plain, that if inſtead of one tube, the diſcharge of the jar was made through one hundred or one thouſand tubes, the impulſe of the ſhock would be proportionably leſſened; and indeed we can hardly form any idea of the ſmallneſs of its power in that caſe. How happens it then that a very ſmall ſhock ſent acroſs the arms of a man, which ſhock, we may reaſonably ſuppoſe, does not occaſion any ſpark within the veſſels of the body, is ſenſibly felt, and produces an involuntary motion, when it paſſes through innumerable veſſels filled with fluids, which are far better conductors than water?

The ſubſtance of the veſſels of the human body is certainly a leſs good conductor than the fluids contained in thoſe veſſels; but it can hardly be ſuſpected, that the electric fluid occaſions the involuntary motion, &c. by going through that ſubſtance rather than through the fluids, which are much better conductors. Perhaps that ſudden involuntary motion is produced by the electric fluid acting upon the nerves. But it ſeems that, independent of the already known parts of the human body, there is ſome other principle that accompanies the life of an animal, which is in a certain manner a conductor of electricity, and whoſe action ceaſes as ſoon as the animal becomes extinct. It has been remarked in ſeveral inſtances, that if an electric ſhock paſſes through a given part of a living animal, the ſame ſhock, after that the animal is dead, will be viſibly tranſmitted over the ſurface of the ſame part, but not through it. This remarkable experiment may be eaſily tried with a mouſe, in the following manner. Charge a large electric jar or a ſmall battery, and by means of two directors, like thoſe delineated in fig. 1. ſend the full charge of it from the head to the back of a mouſe. The animal, if the ſhock is ſufficiently ſtrong, will be inſtantly deprived of life. Immediately after, charge the jar again, and diſcharging it in the ſame manner through the ſame mouſe, after death; it will be often found that the ſhock will no longer go through the body, but will paſs over it in a viſible luminous track; hence we muſt neceſſarily conclude, that ſomething which aſſiſted the paſſage of the ſhock through the body of the mouſe whilſt living, is now either loſt or become inactive.

EXPERIMENT V.

To cryſtallize oil of tartar by means of electric ſparks.

Take a glaſs tube about four inches long, and about one quarter of an inch in diameter, open at both ends, and moiſten the inſide of it with oil of tartar *per deliquium*; then adapt two corks to the extremities of this tube, and introduce a wire through each of them. The extremities of theſe wires within the tube ſhould be about three quarters or one inch from one another. This done, connect one of the wires with the outſide coating of a pretty large electric jar, and the other wire with the above-deſcribed electrometer; then let the jar be diſcharged ſeveral times through the tube; and it will be often found, that the oil of tartar upon the inſide ſurface of the tube, gives manifeſt ſigns of cryſtallization. Now by experiments ſimilar to this, ſome ingenious perſons have pretended to ſhew, that the electric fluid contains an acid, which combining with the oil of tartar, neutralizes it, and occaſions the cryſtallization.—It has even been ſaid, that the phenomena of electricity are the effects of two principles, viz. an acid, which conſtitutes the poſitive, and an alkali, which conſtitutes the negative electricity. It would be uſeleſs to endeavour to refute ſuch an hypotheſis, when a very little acquaintance with the ſubject is ſufficient to manifeſt its abſurdity. It is only neceſſary to obſerve, that in almoſt every combuſtion, there is generated a quantity of an elaſtic fluid, commonly known under the name of *fixed air*; which elaſtic fluid is an acid, and cryſtallizes with oil of tartar. Farther, that the electric fluid, when proceeding with violence from the ſurfaces of conductors, does always burn or calcine a very ſmall portion of theſe conductors; hence the cryſtallization of the oil of tartar, when it happens in the above-mentioned experiment, which is very ſeldom the caſe, and then in a very ſlight degree, muſt certainly be owing to the fixed air generated, and not to the electric fluid itſelf, conſidering it is an acid.

In a ſimilar manner it is ſhewn that the electric ſparks repeatedly taken in a quantity of common air, contaminate it, and precipitate the lime in the lime-water, that is expoſed to it; yet the phlogiſton probably proceeds from thoſe conductors, through which the electric fluid paſſes, and conſequently does not ſhew that the electric fluid itſelf is phlogiſton. This ſuppoſition, that the phlogiſton, which contaminates the air, &c. proceeds from the conductors, through which the electric fluid paſſes, I publiſhed in my *Treatiſe on Electricity*; but it has ſince been rendered much more probable by an obſervation of the learned Mr. Fontana. This gentleman obſerved, that when the wires, through which the ſparks were taken in a quantity of air, were of pure ſilver, which is reckoned a pure metal, the air was phlogiſticated with great difficulty, and in a very ſmall degree; but when braſs or iron wires were uſed, the phlogiſtication was effected much more eaſily. Now this obſervation not only ſhews that the phlogiſton proceeds from the wires, but alſo confirms Father Beccaria's obſervation, viz. that the electric fluid conducts certain ſubſtances along with itſelf in its paſſage. However, theſe ſubſtances ſeem to be neither eſſential to the paſſage of the electric fluid, nor always the ſame.

Conſidering theſe effects of the electric fluid, it might perhaps be ſuſpected, that the acid or the phlogiſton, which accompany that fluid, however they may be originated, could poſſibly be of ſome uſe in medical electricity. But here two things muſt be remarked; firſt, that the quantity of that acid or phlogiſton is exceedingly ſmall; and ſecondly, that all the experiments hitherto made, ſhew that they penetrate a very ſhort way beyond the ſurface of conſiſtent bodies.

Father Beccaria, treating of the medical uſes to which electricity might be applied; The only point, ſays he, about which I have ſome ſuſpicion, is whether the ſparks drawn immediately from any medicine may determine ſome particles of thoſe medicines into the ſkin of the perſon that takes thoſe ſparks. It being a conſtant fact, that the ſparks ſeparate from bodies ſome conducting effluvia, and impel

pel them upon the ſurfaces of thoſe bodies between which they leap. I find that Dr. Franklin has made many ſhocks paſs through his own body, from an electric jar filled with a ſtrong purgative; but it was attended with no particular phenomenon. I do not know if he touched a wire communicating with the inſide of the jar, in which caſe the experiment would afford no proof againſt my ſuſpicion; or if he diſcharged the jar by touching immediately the ſurface of the purgative; and even then the experiment could not afford any general concluſion; it being poſſible that the ſkin does not admit that particular ſort of medicine, in the ſame manner as it does not admit the ſalt of ſea-water. I am ignorant of any particular ſubſtance, but only inquire if there may be ſome ſubſtance, whoſe vapours might be inſinuated through the integuments of the human body by means of electric ſparks. The following is an experiment which bears ſome analogy to it. I put a large drop of mercury in the bottom of a china cup, one ſide of which communicates with the prime conductor. On the oppoſite ſide I fix with pincers two pieces of gold, equally diſtant from the drop of mercury; and conſtantly touching one of them, I oblige the ſparks to paſs from it to the drop of mercury, and after taking many ſparks, I find that the piece of gold which I have touched, has acquired a bluiſh colour on its edge where the ſparks touched. But no mark of any particular colour is perceived upon the other piece of gold.

Thus that elegant electrician ſuppoſes, that poſſibly there may be found ſome ſubſtance, the particles of which the electric ſparks may force into the ſkin of the human body. It is obvious to obſerve, that all the experiments hitherto publiſhed, and the conſiderations deduced from them, ſeem to ſhew that the quantity of the medicine thus poſſible to be introduced into the human body by means of electric ſparks, would be ſo exceedingly ſmall, as to produce no ſenſible effect in caſes of diſeaſes.

HAVING collected together all the obſervations which ſeemed to deſerve the attention of the public, in reſpect to medical electricity, and having arranged them in that order which ſeemed more perſpicuous and natural; I ſhall laſtly recapitulate, in a few words, the properties of electricity upon the human body, both in a ſound and in a diſeaſed ſtate; with which I ſhall conclude this eſſay.

1. Simple electrization, whether poſitive or negative, generally increaſes the ordinary number of pulſations about one ſixth. This effect is pretty conſtant with healthy people, and is alſo often produced in diſeaſed perſons. It conſtantly increaſes the natural perſpiration; and, in general, promotes glandular ſecretions.

2. Electrization has been found to be beneficial in various diſeaſes, and it has very ſeldom produced any bad effects. Indeed it may be ſaid, that it has *never* produced any bad effects, when judiciouſly managed.

3. The diſeaſes in which the application of electricity has been moſtly beneficial, are thoſe ariſing from obſtructions and nervous affections. On the contrary, it has proved leſs beneficial in fluxes or increaſed natural diſcharges; but thoſe unnatural diſcharges which are quite adventitious, as the *fiſtula lacrymalis*, &c. are generally cured by it.

4. Laſtly, it has been obſerved, that the applications of different degrees of electric power, are attended with very different effects, viz. that a moderate electrization has perfectly cured ſeveral diſeaſes, whereas a ſtronger electrization conſtantly increaſed them. But the proper degree of electrization, and the continuance of the application, muſt be learned from the effects it produces daily, and from the feeling of the perſons electrified.

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FINIS.

Fig 1-

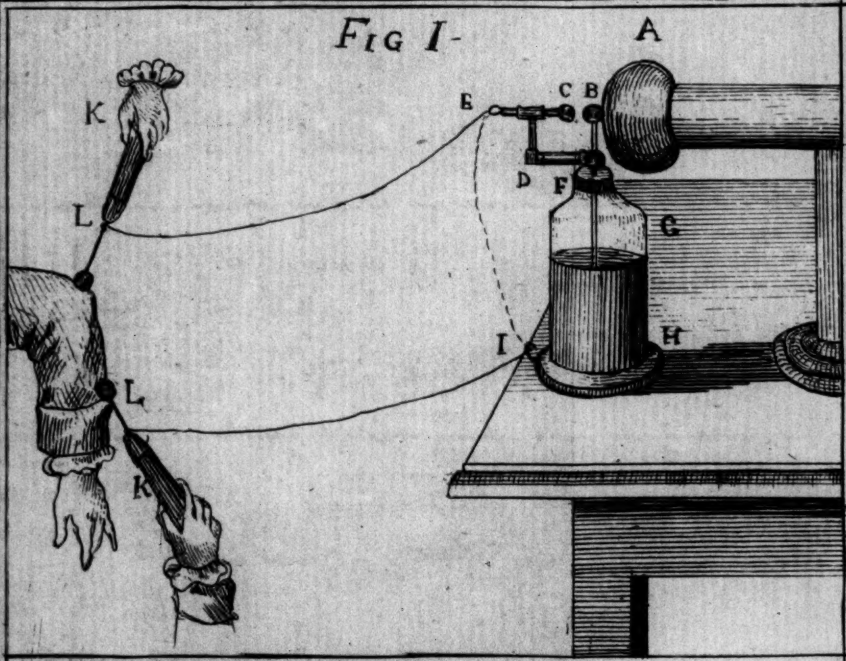

Fig 2-

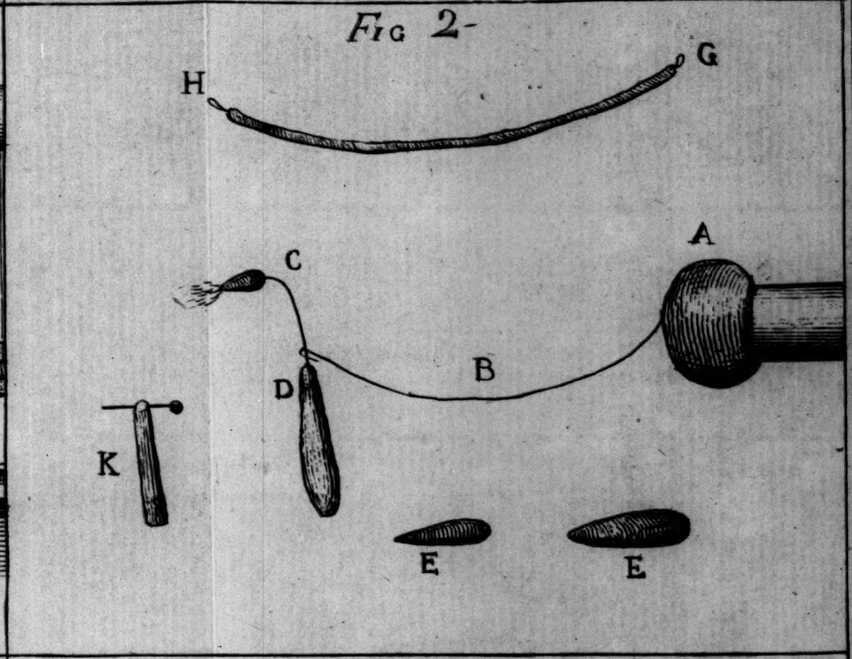

Fig 3-

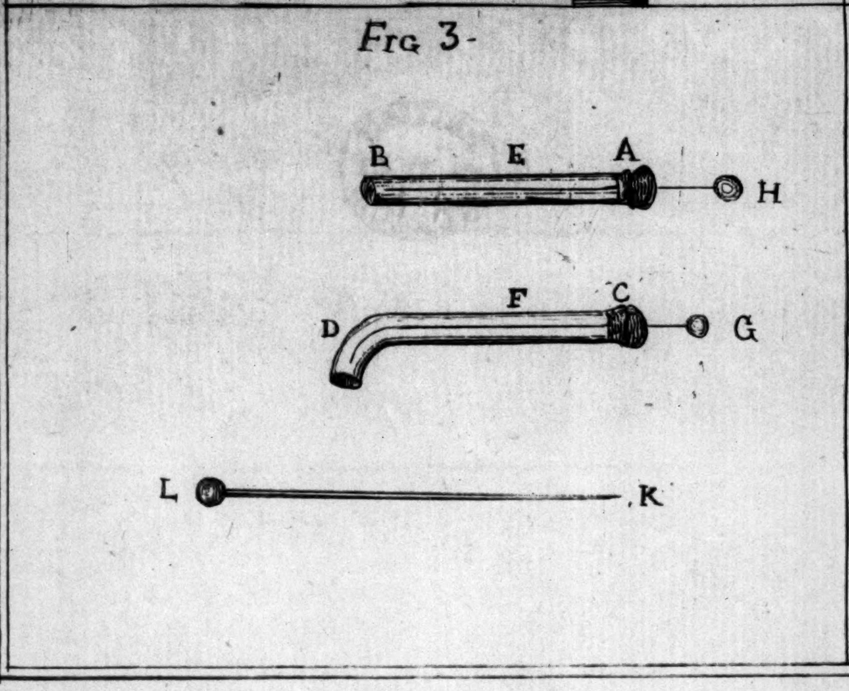

Fig 4-